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CONFIDENTIAL

MONTHLY SUMMARY OF

SPACE

Systems Division

ACTIVITIES

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OCTOBER 1997

SSLPR-79

a foreword to...



SPACE

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HEADQUARTERS
SPACE SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
United States Air Force
Air Force Unit Post Office, Los Angeles 45, California

SSLPR

27 November 1961

Monthly Summary of
SPACE SYSTEMS DIVISION
ACTIVITIES
OCTOBER 1961

FOREWORD

This month's report includes information about the successful aerial recovery of the DISCOVERER XXXII capsule. MIDAS IV was launched on 21 October and successfully placed into a near circular 2000 nautical mile orbit. Valuable payload data was received. The first launch in VELA HOTEL has been delayed one month because of the delay in selecting the Spacecraft contractor. BLUE SCOUT D-8 was launched on 1 November but failed to attain orbit. Preparations are being made for the launch of the MERCURY MA-5 capsule in late November. RANGER II is currently scheduled for launch during the 18 through 26 November period. This will be the second of two Lunar Test Missions. The TRANSIT 4B launch is scheduled for 15 November.


for O. J. RITLAND
Major General, USAF
Commander

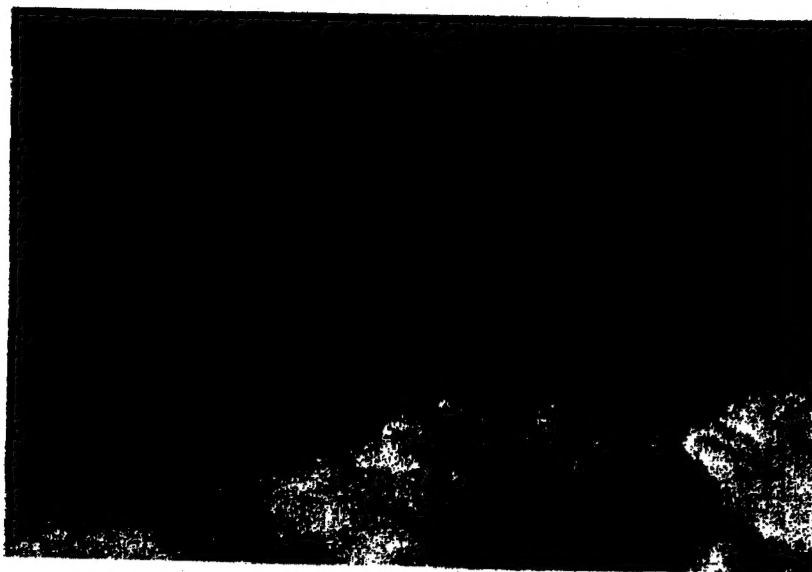
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SATELLITE

SYSTEMS



DISCOVERER
MIDAS
BIOASTRONAUTICS
SATELLITE INSPECTOR
SNAPSHOT
VELA HOTEL

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Flight History

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DISCOVERER No.	DM-21 No.	AGENA No.	Flight Date	Remarks
DISCOVERER FLIGHTS 0 THRU XX ARE ON PAGE A-6				
XXI	261	1102	18 February	Attained orbit successfully. Non-recoverable, radio-metric data gathering MIDAS support flight.
XXII	300	1105	30 March	Launch, ascent, separation, coast and orbital stage ignition normal. Orbital velocity was not attained because of an AGENA hydraulic malfunction.
XXIII	307	1106	8 April	Attained orbit successfully. Loss of control gas prevented proper positioning of the satellite for capsule re-entry. Capsule was ejected into new orbit on re-entry pass.
XXIV	302	1108	8 June	Failed to attain orbit because of a second stage malfunction.
XXV	303	1107	16 June	Attained orbit successfully. Capsule recovered from the ocean after two days on orbit. All objectives achieved.
XXVI	308	1109	7 July	Attained orbit successfully. Capsule was ejected on the 32nd orbit and aerial recovery was accomplished. All objectives achieved.
XXVII	322	1110	21 July	Failed to attain orbit because of severe booster pitch oscillation.
XXVIII	309	1111	3 August	Failed to attain orbit because of a hydraulic failure in the satellite engine control system.
XXIX	323	1112	30 August	Attained orbit successfully. Capsule recovered from the ocean after two days on orbit. All objectives achieved.
XXX	310	1113	12 September	Attained orbit successfully. Capsule was ejected on the 33rd orbit and aerial recovery was accomplished by a C-130. This was the first C-130 air retrieval. All objectives achieved.
XXXI	324	1114	17 September	Attained orbit successfully. Recovery was not achieved because of an on orbit AGENA electrical power malfunction.
XXXII	328	1115	13 October	Attained orbit successfully. Aerial recovery was accomplished after the 18th orbit by a C-130 aircraft.
XXXIII	329	1116	23 October	Failed to attain orbit because of an AGENA malfunction.

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Flight History (continued)

DISCOVERER No.	DM-21 No.	AGENA No.	Flight Date	Remarks
0	160	1019	21 January 1959	<i>AGENA destroyed by malfunction on pad. THOR refurbished for use on flight XII.</i>
I	163	1022	28 February	<i>Attained orbit successfully. Telemetry received for 314 seconds after lift-off.</i>
II	170	1018	13 April	<i>Attained orbit successfully. Recovery capsule ejected on 17th orbit was not recovered. All objectives except recovery successfully achieved.</i>
III	174	1020	3 June	<i>Launch, ascent, separation, coast and orbital boost successful. Failed to achieve orbit because of low performance of satellite engine.</i>
IV	179	1023	25 June	<i>Same as DISCOVERER III.</i>
V	192	1029	13 August	<i>All objectives successfully achieved except capsule recovery after ejection on 17th orbit.</i>
VI	200	1028	19 August	<i>Same as DISCOVERER V.</i>
VII	206	1051	7 November	<i>Attained orbit successfully. Lack of 400-cycle power prevented stabilization on orbit and recovery.</i>
VIII	212	1050	20 November	<i>Attained orbit successfully. Malfunction prevented AGENA engine shutdown at desired orbital velocity. Recovery capsule ejected but not recovered.</i>
IX	218	1052	4 February 1960	<i>THOR shut down prematurely. Umbilical cord mast did not retract. Quick disconnect failed, causing loss of helium pressure.</i>
X	223	1054	19 February	<i>THOR destroyed at T plus 56 sec. by Range Safety Officer. Severe pitch oscillations caused by booster autopilot malfunction.</i>
XI	234	1055	15 April	<i>Attained orbit successfully. Recovery capsule ejected on 17th orbit was not recovered. All objectives except recovery successfully achieved.</i>
XII	160	1053	29 June	<i>Launch, ascent, separation, coast and orbital stage ignition were successful. Failed to achieve orbit because of AGENA attitude during orbital stage boost.</i>
XIII	231	1057	10 August	<i>Attained orbit successfully. Recovery capsule ejected on 17th orbit. Capsule was recovered after a water impact with negligible damage. All objectives except the airborne recovery were successfully achieved.</i>
XIV	237	1056	18 August	<i>Attained orbit successfully. Recovery capsule ejected on 17th orbit and was successfully recovered by the airborne force. All objectives successfully achieved.</i>
XV	246	1058	13 September	<i>Attained orbit successfully. Ejection and recovery sequence completed. Capsule impact occurred south of the recovery forces; located but lost prior to being retrieved.</i>
XVI	253	1061	26 October	<i>Launch and ascent normal. AGENA failed to separate from booster and failed to attain orbit.</i>
XVII	297	1062	12 November	<i>Attained orbit successfully. Recovery capsule ejected on 31st orbit and aerial recovery was accomplished. All objectives were successfully achieved.</i>
XVIII	296	1103	7 December	<i>Attained orbit successfully. Recovery capsule ejected on 48th orbit and aerial recovery was accomplished. All objectives were successfully achieved.</i>
XIX	258	1101	20 December	<i>Attained orbit successfully. Non-recoverable, radio-metric data gathering MIDAS support flight.</i>
XX	298	1104	17 February	<i>Attained orbit successfully. Capsule did not re-enter due to on-orbit malfunction.</i>

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MONTHLY PROGRESS — DISCOVERER

Flight Test Progress

DISCOVERER XXXII Flight

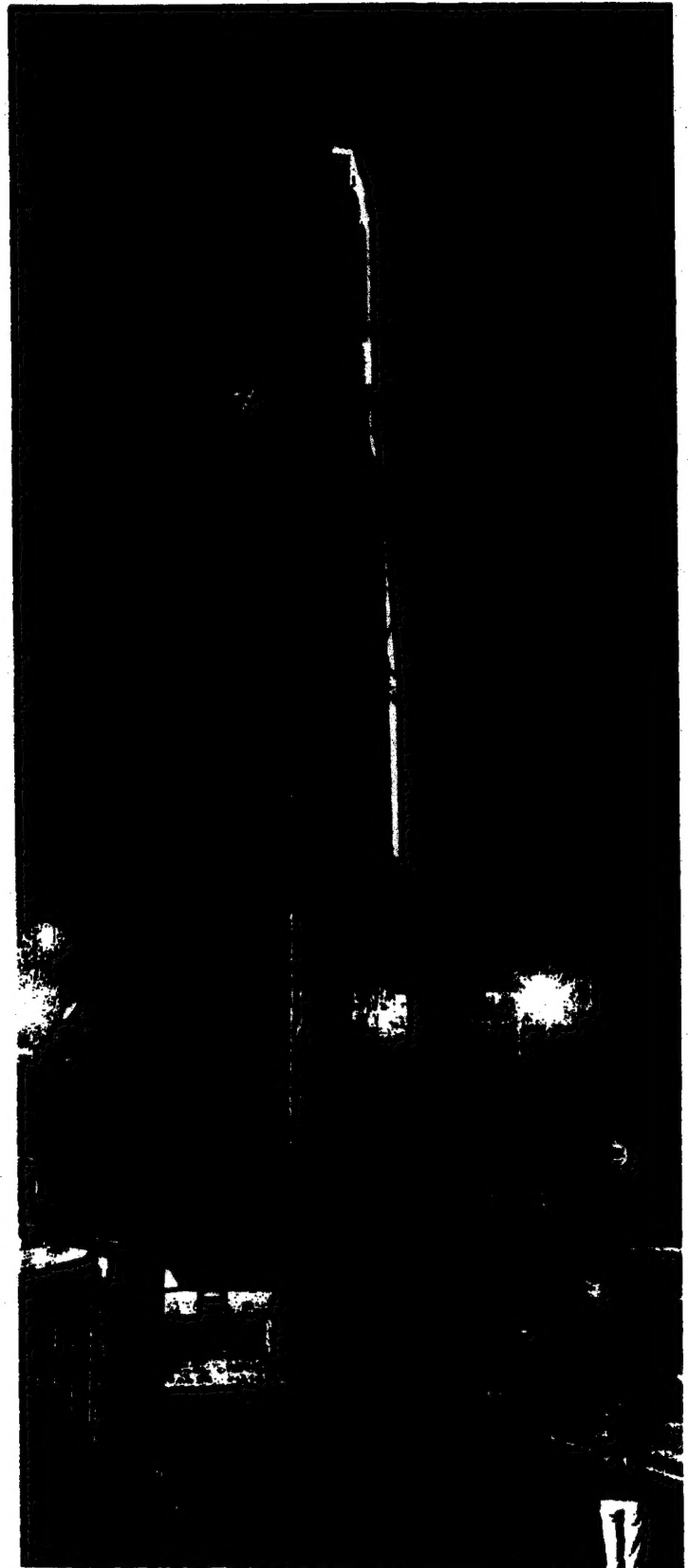
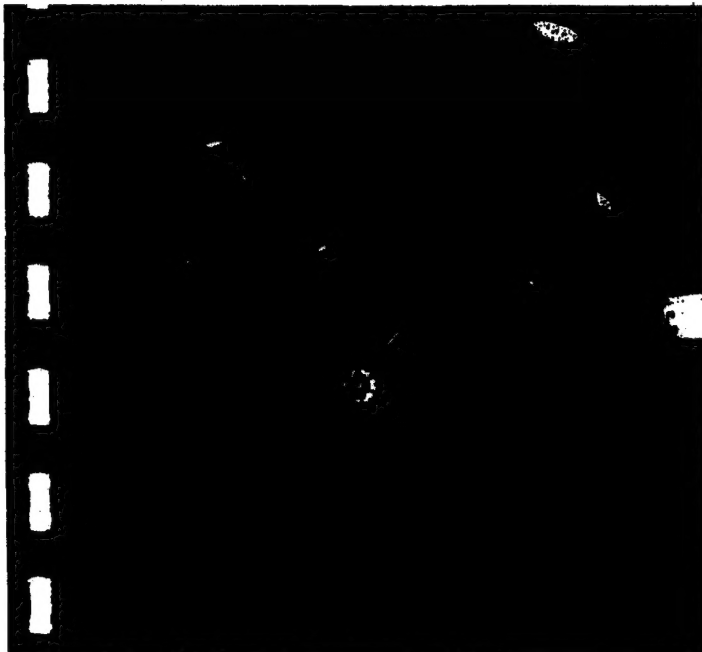
● DISCOVERER XXXII was launched from Complex 75-3, Pad 4, at Vandenberg Air Force Base at 1053 PST on 13 October. All events during launch, boost, separation, coast, AGENA burn, and orbital injection occurred as planned. The orbit attained was almost exactly as programmed as shown in Table I. (U)

Event	Programmed	Actual
Apogee, statute miles	259.02	251.15
Perigee, statute miles	146.20	144.01
Period, minutes	91.0	90.85
Eccentricity	0.0135	0.0128

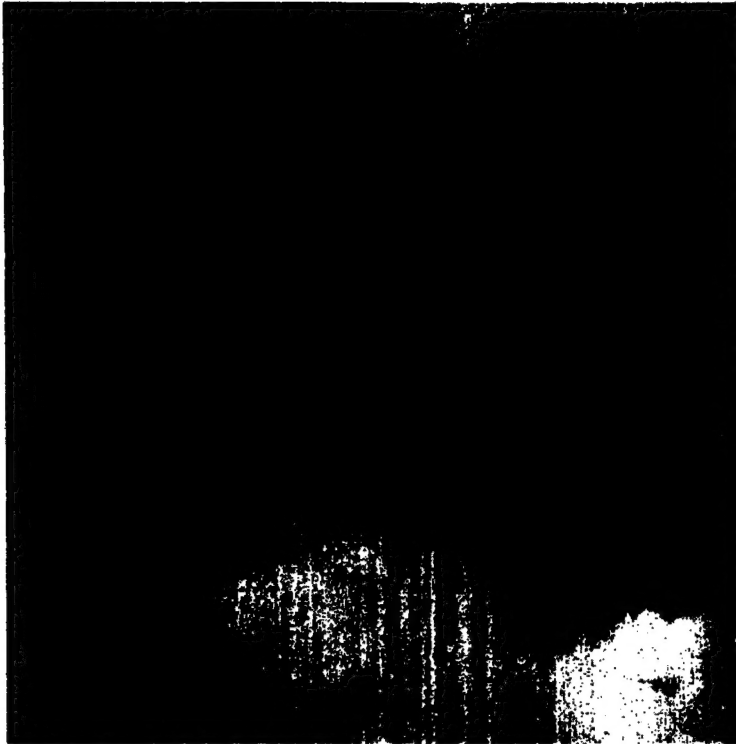
Table I. PROGRAMMED AND ACTUAL ORBITAL PARAMETERS FOR DISCOVERER XXXII.

● Based on satellite operation, the decision was made to recover the capsule on the 18th pass. Capsule separation occurred at 1437 PST on 14 October over Alaska and re-entry occurred over the impact area near Hawaii. The descending capsule

Figure 1. View inside the missile shelter (below) looking into the DM-21 interstage structure. The flight controller and inertial reference package (BTL guidance system components) are visible in the upper right. DISCOVERER XXXII erected on Complex 75-3, Pad 4. This vehicle was successfully launched on 13 October.

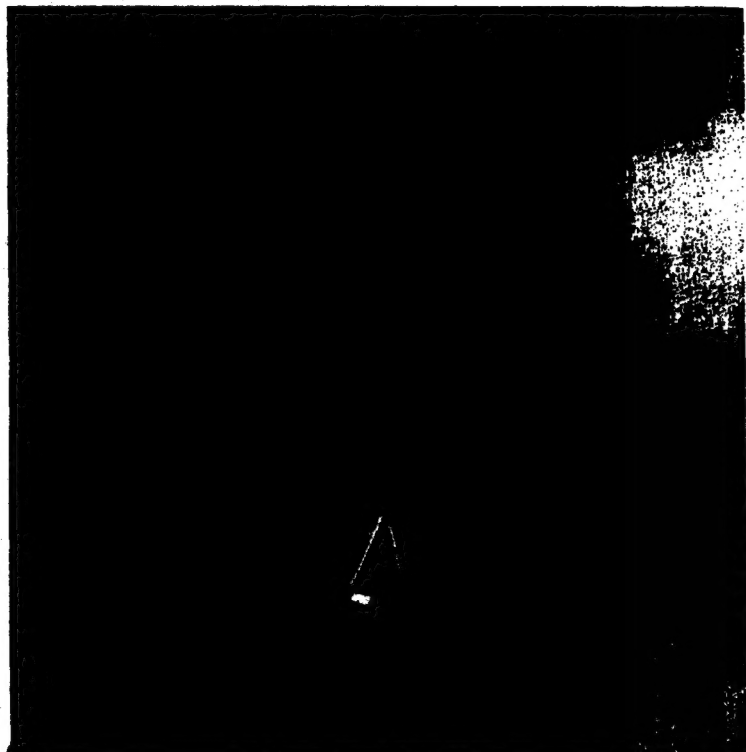
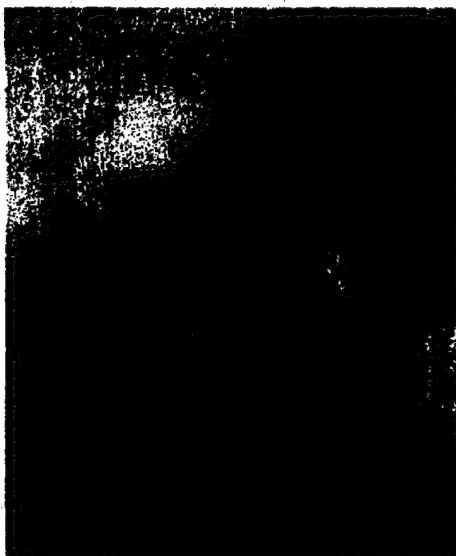


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FIRST PASS...Parachute (left) is missed by the hooks trailing from the C-130 recovery aircraft and continues its descent.

SECOND PASS...Hooks snare parachute canopy and the DISCOVERER XXXII capsule is reeled in. This is the second recovery by a C-130 aircraft.



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was located by radar and DISCOVERER direction finder equipment on board the aircraft and ships in the recovery force. The capsule was first sighted at 28,000 feet by the crew of one of the C-130 recovery aircraft. This aircraft snagged the parachute canopy on its second pass and reeled the capsule aboard. This was the second successive aerial recovery by a C-130 aircraft. Five of these planes have recently been assigned to the recovery force to replace the C-119's previously used. The C-130's are faster, have longer range, and can be used to recover the heavier capsules under development in other programs. (U)

DISCOVERER XXXII Experiments

- Samples of various materials were carried in and recovered with the DISCOVERER XXXII recovery capsule. These included solar cells, dosimetry packs, and a pack containing shielding material, nuclear blocks and metallic discs. These were returned to various Air Force organizations for analysis of space radiation effects. A cannister containing approximately 500 kernels of corn was also in the capsule and was returned to the Air Force. This corn will be planted to determine the mutations resulting from exposure to space radiation. (U)

- A University of Illinois experiment was con-

ducted in an attempt to determine the southern boundary of an ionospheric disturbance which causes attenuation of RF signals from satellites in the northern hemisphere. A small 20 megacycle transmitter was mounted on DISCOVERER XXXII and it transmitted a continuous, unmodulated signal. Stations located throughout the world recorded the signal and the results are currently being analyzed. (U)

- In cooperation with the Army Signal Corps, a Sequential Collation of Range (SECOR) experiment package was carried aboard DISCOVERER XXXII. The package contains a transponder which can be interrogated from ground stations and is used as a means of determining the precise distances between the various stations. The SECOR Program will permit precision mapping of the world. (U)

- DISCOVERER XXXII also carried Air Force Geophysical Research Directorate equipment consisting of an erosion detector, an electron density gauge, and a charged particle energy analyzer. Data from these instruments were transmitted to ground stations by the DISCOVERER telemetry system and sent to the Geophysical Research Directorate for analysis. (U)

DISCOVERER XXXIII Flight

- DISCOVERER XXXIII was launched from Complex 75-3, Pad 5, at Vandenberg Air Force Base on 23 October. DM-21 boost, separation, coast, and



Figure 2. Air Force Geophysical Research Directorate instruments mounted on the DISCOVERER XXXII AGENA vehicle. These space environment experiments are a portion of those carried to utilize the increased AGENA weight carrying capability. A University of Illinois experiment and an Army Signal Corps SECOR package were also carried on this flight.

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AGENA ignition occurred as planned. However, operation of the hydraulic system which provides the motive power for engine gimbaling was erratic. The violent maneuvers of the satellite during this period resulted in disturbance of the gyro references and the satellite started on an extremely high trajectory. About 162 seconds after AGENA ignition, the hydraulic pressure dropped abruptly to zero and control of engine position was lost. Approximately ten seconds later, the XLR-81Ba-9 engine shut down. It is assumed that this premature cutoff resulted from the high acceleration forces imposed on the uncontrolled vehicle. The AGENA impacted in the south Pacific. (C)

● Because of the hydraulic system difficulties on this and two previous flights (DISCOVERER XXVIII

on 3 August and DISCOVERER XXII on 30 March), an extensive analysis and test program was started immediately. Hot firing tests at the Santa Cruz Test Base have been conducted and laboratory tests at both the Lockheed and Bell facilities were initiated. Areas of investigation include mechanical weakness, contamination in the hydraulic system, and contamination resulting from UDMH chemical action or foreign material in the UDMH. (UDMH contamination could affect the hydraulic control system because the hydraulic pressure pump is driven by a hydraulic motor which gets its power from UDMH pressure and flow). Each system must be thoroughly rechecked before launch to be certain there is no contamination. No rescheduling will be necessary. (C)

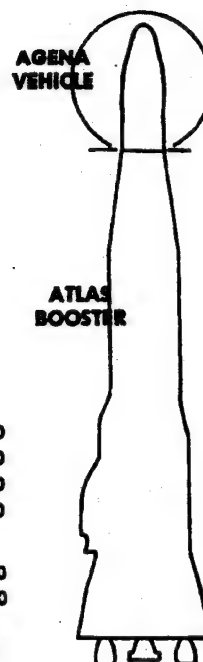
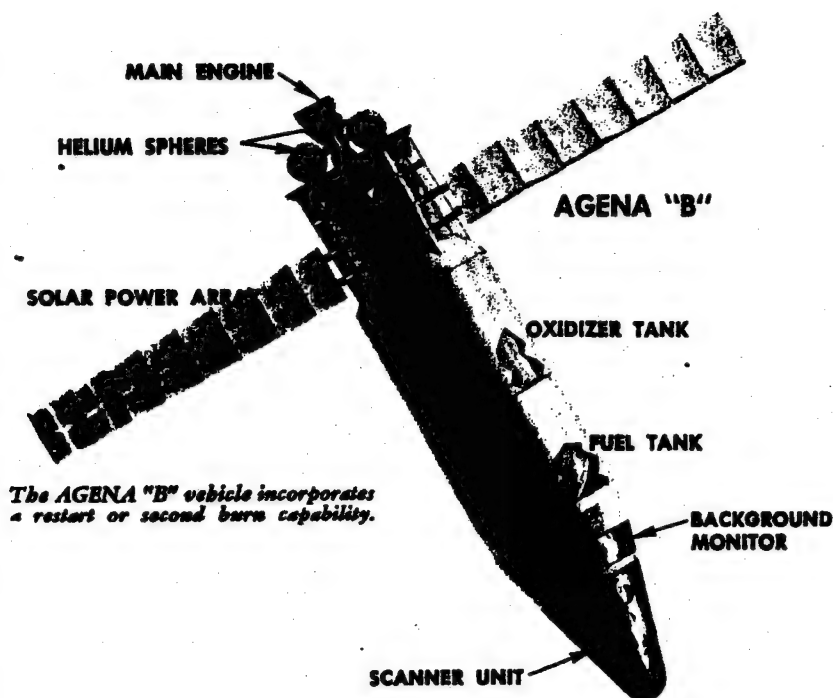
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SECOND STAGE

AGENA
"B"

Weight—	
Inert	1,763
Payload equipment	1,641
Orbital	3,404
Impulse Propellants	12,950
Fuel (UDMH)	
Oxidizer (IRFNA)	
Other	758
GROSS WEIGHT (lbs.)	17,112
Engine	XLR81-8c-9
Thrust, lbs. (vac.)	16,000
Spec. Imp., sec. (vac.)	290
Burn Time, sec.	240
Restart Provisions	Yes

MIDAS



BOOSTER—ATLAS ICBM

Weight—Dry	15,100
Fuel, RP-1	74,900
Oxidizer (LOX)	172,300
GROSS WEIGHT (lbs.)	262,300

Engine—MA-2

Thrust (lbs. vac.)	Boost	356,000
	Sustainer	82,100
Spec. Imp. (sec. vac.)	Boost	286
	Sustainer	310

PROGRAM HISTORY

The MIDAS Program was included in Weapon System 117L when WS 117L was transferred to the Advanced Research Projects Agency. ARPA subsequently separated WS 117L into the DISCOVERER, SAMOS and MIDAS Programs, with the MIDAS objectives based on an infrared early warning system. The MIDAS (Missile Defense Alarm System) Program was directed by ARPA Order No. 38, dated 5 November 1958 until transferred to the Air Force on 17 November 1959. The Air Force directed that the program be continued under the technical guidance of the ARPA Order and approved the MIDAS R&D Development plan dated 15 January 1960. This plan was a "minimum essential" program directed toward the satellite vehicle and proof of the feasibility of infrared detection capabilities. It provided for ten test launches, two from the Atlantic Missile Range and eight from the Pacific Missile Range. Subsequent authorization was obtained to utilize two DISCOVERER flights (designated RM-1 and RM-2) to carry background radiometers in support of MIDAS.

A program of complete system development, including the ground environment of MIDAS, has been submitted to the Department of the Air Force and has been approved in principle and objective. Authorization has been received to initiate action implementing the plan with reconsideration for approval to be accomplished subsequent to a successful test launch in 1961.

TECHNICAL HISTORY

The MIDAS infrared early warning payload is engineered to use a standard launch vehicle configuration. This consists of an ATLAS missile as the first stage and the AGENA vehicle, powered by a Bell Aircraft rocket engine as the second, orbiting stage. The final configuration payload weight will be approximately 1,000 pounds.

The first two R&D flights used the AGENA "A" and ATLAS "D" vehicle programmed to place the payload in a circular 261 nautical mile orbit. Subsequent R&D flights utilize the ATLAS "D"/AGENA "B" configuration programmed to place the payload in a circular 2,000 nautical mile polar orbit.

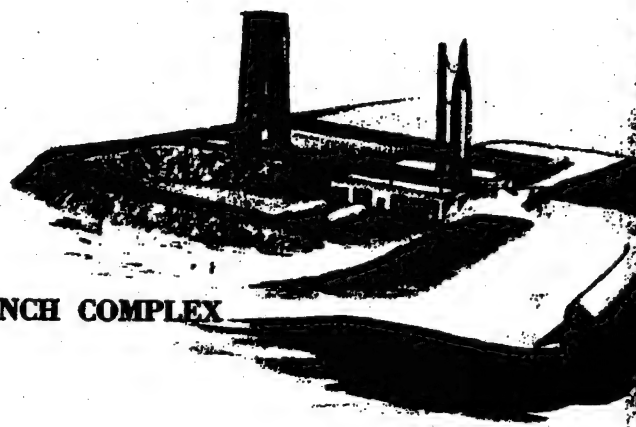
CONTROL AND DISPLAY FACILITY



Orbiting satellites detect infrared radiation emitted by ICBM's in powered flight. Data is telemetered instantaneously to Midas Tracking and Control Center via far north Readout Stations. Decoded data reveal approximately the number of missiles launched and launch location, direction of travel and burning characteristics. This data is displayed in near real time on the control consoles and operational displays at the Control and Display Facility. The Tracking and Control Center monitors and controls the status of the orbital network and the ground environment. The Point Arguello Stands are used to launch the MIDAS R&D satellites into polar orbits.



LAUNCH COMPLEX



Satellite Vehicle

Eight MIDAS Satellites — four each in
two orthogonal polar orbital planes
— at 2,000 n.m. altitude

Donnell

Antenna

READOUT STATION

Electronic Equipment

ENTER

Sunnyvale
Satellite Test Center

Point Arguello Launch Complex

New Boston
Acquisition
Station

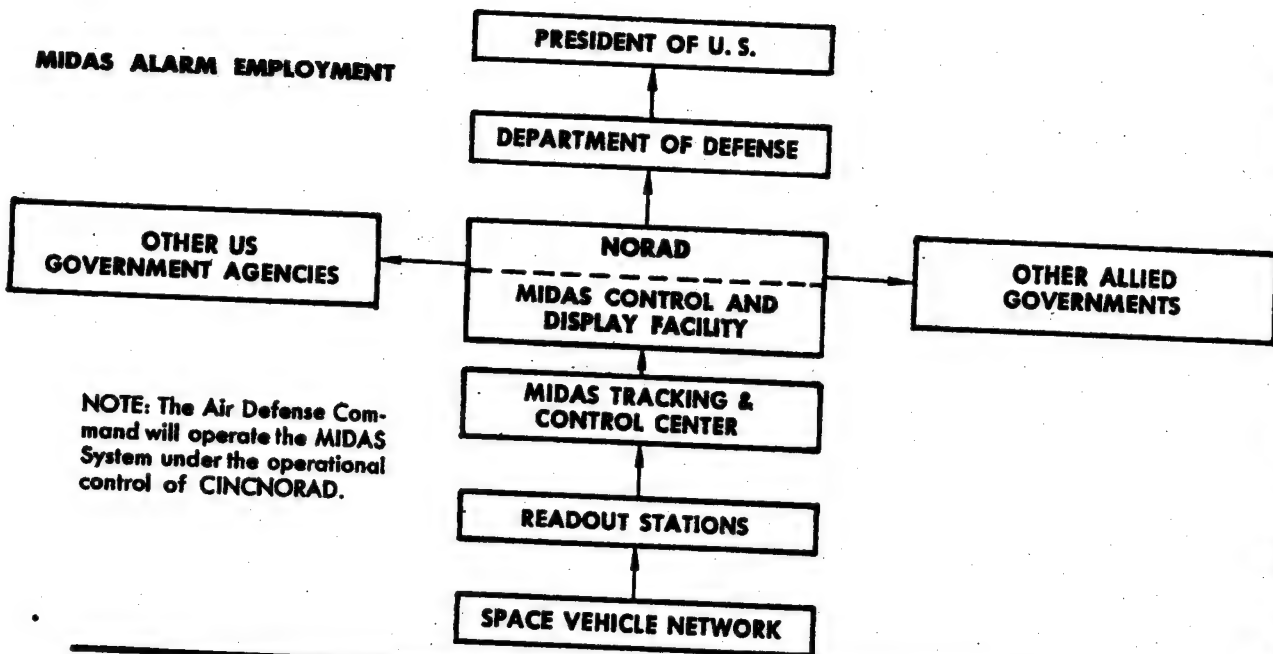
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MIDAS ALARM EMPLOYMENT



CONCEPT

The MIDAS system is designed to provide continuous infrared coverage of the Soviet Union. Surveillance will be conducted by eight satellite vehicles in accurately positioned orbits. The area under surveillance must be in line-of-sight view of the scanning satellite. The system is designed to accomplish instantaneous readout of acquired data by at least one of three strategically located readout stations. The readout

stations transmit the data directly to the MIDAS Tracking and Control Center where it is processed. It is then displayed and evaluated in the MIDAS Control and Display Facility. If an attack is determined to be underway, the intelligence is communicated to a central Department of Defense Command Post for relay to the President and national retaliatory and defense agencies.

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Flight History

MIDAS No.	Launch Date	ATLAS No.	AGENA No.	Remarks
I	26 February	29D	1008	Did not attain orbit because of a failure during ATLAS/AGENA separation.
II	24 May	45D	1007	Highly successful. Performance with respect to programmed orbital parameters was outstanding. Useful infrared data were observed and recorded.
RM-1	20 December	DISCOVERER Vehicle		Despite satellite oscillations, sufficient data were obtained for evaluation of payload operation. Information obtained in the 2.7-micron region agrees with data obtained from balloon-borne radiometric equipment. Intensities in the 4.3-micron region were somewhat higher than had been anticipated from theoretical studies.
RM-2	18 February	DISCOVERER Vehicle		All channels functioned properly and valid data were obtained on six stable orbits. Data confirmed previous radiometric measurements.
III	12 July	97D	1201	Extremely successful. Second firing of the second stage occurred as programmed. AGENA B vehicle was stabilized in an 1850 nautical mile circular orbit with an eccentricity of 0.0039. Operation of the payload and data link was excellent. Because of an electrical power loss, apparently caused by the failure of one solar array panel to extend, data acquired subsequent to pass five was limited to Van Allen belt radiation information. Inability to properly control power consumption by appropriate and timely vehicle command programming resulted in nearly complete power deterioration within the succeeding several orbits. Van Allen radiation measurements will be obtained during the anticipated 60-90 day battery life of the High Energy Proton Damage Experiment (HEPDEX) package.
IV	21 October	105D	1202	Despite a loss of roll control during the ATLAS boost phase, the satellite vehicle was successfully placed into a near circular 2,000 nautical mile orbit with 0.0125 eccentricity. Several complete revolutions and a significant spin (roll) velocity component was imposed on the AGENA B prior to separation. By expending a greater amount of control gas than normal, the AGENA vehicle was able to control the ATLAS generated disturbance. Telemetry reported accomplishment of all programmed events including expulsion of the West Ford package after second burn. All vehicle functions, with the possible exception of "on orbit" attitude control, occurred as planned. Electrical power output from the solar array exceeded expectations. All telemetry channels (e.g., status and performance of vehicle and payload, SAPUT, HEPDEX) provided good data. A cyclic variation in telemetry signal strength indicated a probable vehicle, on orbit, stability/attitude discrepancy. Subsequent data reduction verified the vehicle instability. Telemetry also indicated a vehicle electrical power degradation commencing about pass 31. On pass 63, seven days after launch, telemetry contact, with the exception of HEPDEX, was no longer enabled. The HEPDEX is expected to transmit data for the 50 to 60 day nominal life of its separate battery power supply. The acquisition of extensive data, on all telemetry channels, over an extended time period in a 2000 nautical mile orbit, made this an exceptionally successful R&D test.

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MIDAS GROUND SUPPORT FACILITIES

Facility	Equipment*	Flight Function
Satellite Test Center	ABCDEP	Operations control, orbit computations and predictions, initiation of commands to satellite (via tracking stations), process payload data.
Vandenberg AFB Tracking Station	ABCEFGHIJKLMP	Ascent and orbital tracking; telemetry reception; trajectory computations; command transmission; reception recording and processing of payload data.
Downrange Telemetry Ships	GHIJNO	Tracking and data reception during ascent. (Three ships are available for this function. Equipment is typical.)
Hawaiian Tracking Station	BEFGHJ	Orbital tracking, telemetry reception, payload data reception.
AMR	HJ	Orbital data reception.
New Hampshire Station	ABCEFGHIJKLM	Orbital tracking; telemetry reception; command transmission; reception, recording and transmission of payload data.
African Tracking Station	BEGJ	Telemetry reception and recording during second burn.
North Pacific Station	BCEHKP	Satellite and payload data reception.
Kodiak Tracking Station	FJ	Orbital tracking.
Mugu Tracking Station	BEFGJ	Tracking and telemetry reception.

- NOTES:** (1) In addition to equipment listed, all stations have inter- and intra-station communications equipment and checkout equipment.
- (2) Equipment listed is either presently available or planned and approved for procurement.

*Equipment

- A. General Purpose Computer(s) and Support Equipment
- B. Data Conversion Equipment
- C. PICE
- D. Master Timing Equipment
- E. Control and Display Equipment
- F. VERLORT
- G. VHF FM/FM Telemetry Station
- H. PAM FM Ground Station

- I. Doppler Equipment
- J. VHF Telemetry Antenna
- K. UHF Tracking and Data Acquisition Equipment (60 foot P&D Antenna)
- L. UHF Angle Tracker
- M. UHF Command Transmitter
- N. APL Doppler Equipment
- O. SPQ-2 Radar
- P. Midas Payload Evaluation and Command Equipment

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MONTHLY PROGRESS—MIDAS

Program Administration

● The DDR&E special task group, established to evaluate MIDAS feasibility and capability, convened at Stanford Research Institute (SRI), Palo Alto, California on 25-28 October. Findings of the subcommittees, established during the initial session in late September, were reported and discussed preparatory to reporting the Task Group findings. (C)

● Representatives from Space Systems Division (AFSSD) and Lockheed Missiles and Space Company (LMSC) met on 3 October to review overall plans and costs. The failure to make schedules, the slippages and associated increased costs make it impossible to meet all Fiscal Year 1962 program objectives. This necessitates an adjustment of phasing and scope of the MIDAS Program including a reduction in the effort to develop a nitrogen tetroxide (N_2O_4) engine and secondary propulsion system (orbit adjust) for the AGENA satellite vehicle. Redirection of Aerojet-General and Baird-Atomic MIDAS Series III and IV payload development effort was accomplished during September to keep within budget allocations. (S)

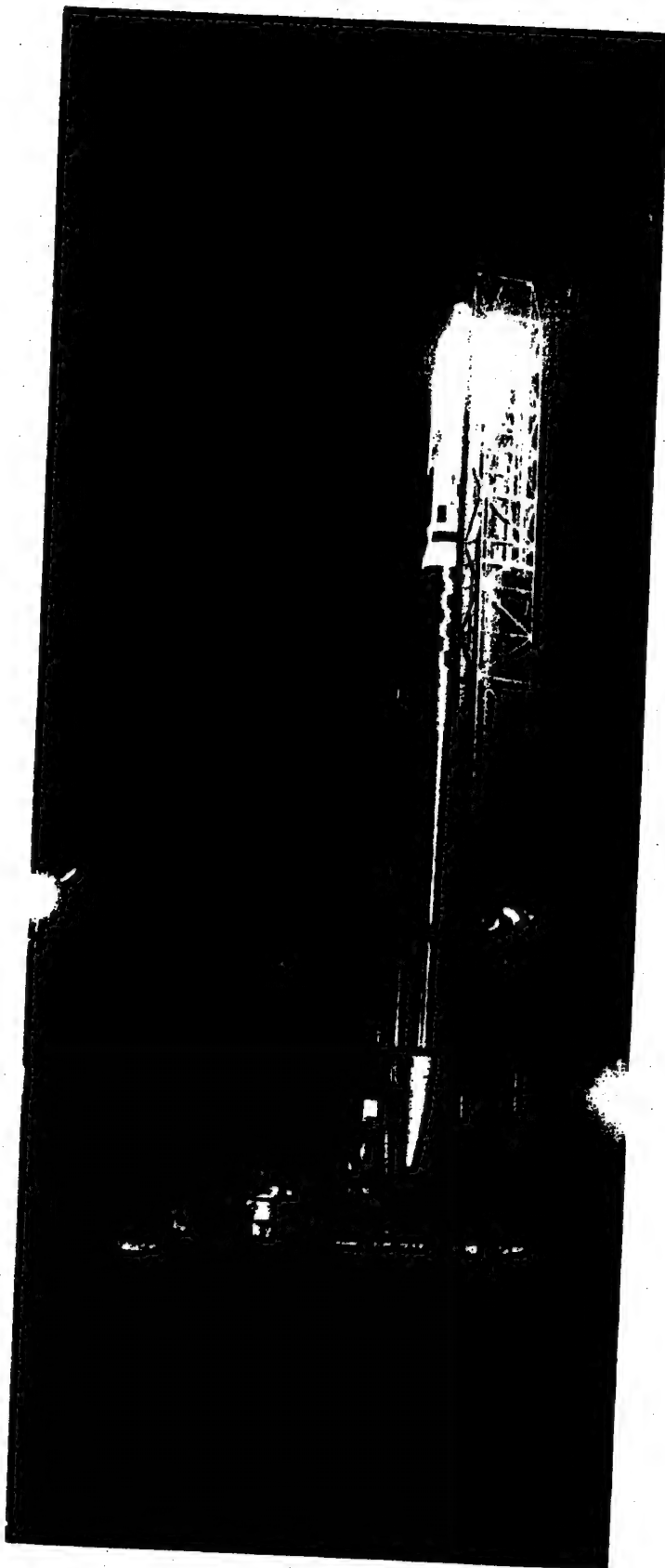
● The MIDAS III Payload Data Analysis and Evaluation Report was distributed on 15 October. This report describes the major payload elements used on the mission and their function. It also discusses the methods used in gathering and processing the read-out data. An analysis and evaluation of payload performance and the data processed is presented. Included in the report are analyses of the payload thermal design and weather conditions while the satellite was on orbit. (U)

Flight Test Progress

● MIDAS III HEPDEX data have been reduced and a report issued on the proton flux levels experienced at the MIDAS orbital altitude. At 180 MEV the proton flux density is about equal to that predicted from other experimental data. However, at 60 MEV the proton flux density was one to two orders of magnitude above the predicted level. (U)

● Due to the erratic motion of the vehicle (MIDAS III) the solar panel data, although reduced, showed time varying discrepancies and therefore is not conclusive. (C)

Figure 1. MIDAS IV before launch on the morning of 21 October from Point Arguello Launch Stand No. 2.

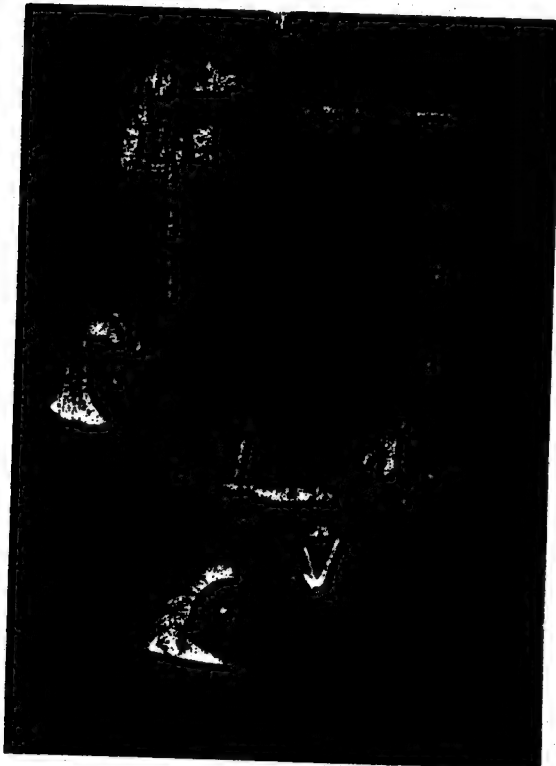


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*Figure 2. Preparing to raise
AGENA 1202 (left) for mating
with ATLAS 105D...Installing
the Baird-Atomic infrared
detection payload...Positioning
the protective shroud over the
payload...LIFTOFF.*



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● MIDAS IV, delayed because of an AGENA engine fuel pump seal drain line problem, was successfully launched from Point Arguello at 0553 PST on 21 October. Despite a loss of roll control during the ATLAS boost phase, the satellite vehicle was placed into a near circular 2000 nautical mile orbit. Table I shows the predicted and attained orbital parameters.

(C)

Event	Programmed	Actual
Apogee, nautical miles	2100	2025
Perigee, nautical miles	2100	1898
Period, minutes	172.6	166
Eccentricity	0.00046	0.0125
Inclination, degrees	90.02	95.87

Table I. COMPARISON OF PROGRAMMED AND ACTUAL ORBITAL PARAMETERS FOR MIDAS IV

● Telemetry channels (e.g., status and performance of vehicle and payload, SAPUT, HEPDEX) provided considerable high quality data. Pertinent items that have been extracted from the data are as follows:

1. Acquisition, tracking, and response to commands from the ground were near perfect. (U)
2. During sustainer operation, the ATLAS booster rolled several times at a rate which reached a minimum of $72^\circ/\text{sec}$ and was $44^\circ/\text{sec}$ at AGENA separation. The total ATLAS/AGENA roll was 8.7 revolutions. The AGENA reduced the roll rate to zero after approximately one additional revolution. To accomplish this, twenty percent of the attitude control gas was expended. (C)
3. Successful ejection of the West Ford package following AGENA second burn and continued operation of the High Energy Proton Density Experiment (HEPDEX) equipment has been confirmed by telemetry data. (U)
4. All operating subsystems, including the solar power arrays and payload, functioned satisfactorily except that the control gases were depleted on pass 1. On pass 34, one solar array turned away from the sun with the result that insufficient power was generated to maintain system operations beyond pass 54. (C)
5. Analysis of the telemetry data shows:
 - a. The vehicle is rotating about the pitch axis in a direction opposite to the direction of vehicle travel at a rate of approximately one revolution per 92 sec. (C)
 - b. The vehicle is stable about its yaw axis within five degrees. (C)
 - c. The vehicle roll axis is displaced twelve

degrees from vertical in a direction away from the sun. (C)

Technical Progress

● MIDAS V completed systems tests early in October and was placed in bonded storage pending insertion into the launch schedule. Prior to commencing the final systems test, the Space Systems Division decided to install a new Baird-Atomic, Inc. payload. The new payload is much more sensitive than the one originally installed in the satellite. This payload has the improved optical system that was initially flown in MIDAS IV and is expected to provide more precise infrared radiation data. Because of launch stand availability problems, the MIDAS V booster vehicle has been removed from the stand and is being held for launch in the near future. The completion of Point Arguello Launch Complex No. 2 construction will alleviate the present stand loading problem. (S)

● MIDAS VI commenced guidance and control and communications compatibility tests on 24 October. The integrated systems test of this vehicle is scheduled to begin on 10 December. (C)

Facilities

- Lockheed representatives have briefed Space Systems Division personnel on an operational concept for a MIDAS Tracking and Control Center. A configuration description report of this facility will be published in December 1961. (U)
- A review of final plans and specifications for the first increment of the support facilities at the Ottumwa, Iowa, Tracking and Control Center was held on 31 October. Advertising for construction contract award for the technical facilities and support facilities at this station is delayed pending release of funds. (U)
- All construction at Point Arguello Launch Complex No. 2 is progressing satisfactorily. Construction completion is estimated at 9%. Walls and foundations of Launch Stand No. 3 and the foundations for the Technical Support and Launch Operations Buildings have been completed. The cable vault and footings for Launch Stand No. 4 have been poured. The Technical Support Building is being erected and utilities are being installed. (U)
- Modification of Building 6007, one of the Vandenberg Air Force Base technical support buildings, has been completed. Modification work on 18 of the 20 buildings in the second increment of this package is approximately 40% complete, with completion scheduled for January 1962. The remaining portion

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of the second increment package will be awarded if FY-62 Military Construction Program funds are released. (U)

● Bid documents for the addition and modifications to the Data Acquisition and Processing Building at the Vandenberg Tracking and Telemetry Station were revised to reduce the scope of the project within available funding. The Corps of Engineers has been requested to advertise this project for bids on a 150-

day construction schedule to allow beneficial occupancy by 15 March 1962. Except for minor deficiencies, construction of the auxiliary power system at this station has been completed. (U)

● Design concepts for the administrative addition to the Satellite Test Annex, Sunnyvale, California, were approved on 11 October and design has been initiated. The preliminary design review is scheduled for 17 November. (U)

Figure 3. Herd of American buffalo (Bison) shows little concern for the MIDAS radome as they graze near the Donnelly Flats, Alaska, tracking station. View, right, inside the radome shows the UHF tracking antenna.



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BIOASTRONAUTICS



ORBITING SPACE CAPSULE



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Program History

The BIOASTRONAUTICS Office was established in May 1958 and charged with the biotechnical supervision of the early military "Man-in-Space" Program and the Bioastronautics aspects of the DISCOVERER Program. NASA was subsequently assigned the "Man-in-Space" responsibility in the fall of 1958. On 13 May 1959, a MARK I biomedical capsule was successfully flown on DISCOVERER III without specimens. The flight telemetry successfully demonstrated the engineering concept of the Bioastronautic subsystem. Although re-entry was successful, recovery was not accomplished. A second MARK I capsule was launched on DISCOVERER IV on 25 June 1959 with four mice aboard. Although orbit and recovery were not achieved, 600 seconds of telemetry showed the animals to be in good condition throughout the flight. Subsequent DISCOVERER efforts culminated in preparation of a MARK II capsule suitable for a small primate which has not been flown.

Applied Research contracts for the design and development of advanced biocapsule hardware include photosynthetic oxygen production, super-critical gas storage, radiation shielding and bio-instrumentation. All components are scheduled to be flown in subsequent advanced space biocapsule programs.

An Advanced Biomedical Capsule has successfully completed the mockup phase of development. The capsule is designed to carry a fifty pound chimpanzee to altitudes of about 10,000 n.m. to thoroughly explore and assess the radiation hazards of the inner and outer Van Allen Belts. In addition, long-term weightlessness effects will be investigated. On 7 November 1960, Space Systems Division approved continued development of the advanced capsule in support of eventual manned military space systems. In July 1961, Hq USAF approved the Advanced Technology Program entitled "Bioastronautics Orbital Space Satellite" (BOSS). This program describes a Bioastronautics Orbital Space System utilizing the ATLAS D/AGENA B vehicle combination for launch, orbit, and recovery of living subhuman specimens. The system will be used for six earth orbit launches during which large primates will be exposed to the space environment for periods from 3 to 14 days so

that effects of long term weightlessness, radiation fields, and extended isolation can be measured and evaluated for periods of from 3 to 14 days. Results can easily be projected directly to a manned system since large primates are quite similar to man physiologically and are known to have a rather high order of intelligence. This is not a biomedical program to collect a great amount of data from animal orbital flights, but is a system to determine the feasibility of manned military operations in space.

Program Concept

The complete exploration of space, including limits to manned operational space systems, requires a determination of the biological effects of the space environment. The Space Systems Division is continuing its aggressive research and development program in this technical area to insure that sufficient bioastronautics knowledge will be available during the 1963-1965 time period. Present deficiencies in reaching these goals are: capsule development, life support system design, biological instrumentation and determination of space flight stresses (long term weightlessness, operational experience in the radiation belts, and isolation). Neither Project MERCURY with its short duration, low altitude orbit, nor DYNA SOAR with its low altitude suborbital flight will provide data concerning the key problems of long term weightlessness and Van Allen Belt radiation; knowledge which is crucial to manned operational space systems.

The current BIOASTRONAUTICS Program is furnishing a limited amount of data from actual ballistic and orbital flights. Experiments include those made on a space-available basis aboard scheduled ICBM and DISCOVERER Program flights. The Bioastronautics Orbital Space Satellite (BOSS) Program will not be limited by piggy-back or space-available restrictions. Data obtained from these tests will be available for correlation with those obtained from laboratory experiments. The results will be of supplemental significance to the DYNA SOAR Program and Project MERCURY and will be necessary to the success of future manned military missions.

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MONTHLY PROGRESS—BIOASTRONAUTICS

Passenger Pods

● On 2 October, following a sixty-day postponement caused by basic ATLAS E booster problems, the Scientific Passenger Pod Program was reinstated. During the pod flight moratorium ATLAS development vehicles were launched, thus reducing the number of vehicles available for passenger pod flights. Because of this several pods have been deleted from the program. One of these is Passenger Pod No. 1. It was to have carried five BIOASTRONAUTIC experiments consisting of the supercritical storage system, the gravity independent photosynthetic gas exchanger (GIPSE), zero gravity potassium superoxide gas diffusion experiment and two tissue equivalent radiation experiments. (C)

● The Space Systems Division is attempting to have Pod No. 1 flown aboard another vehicle. The Office of Aerospace Research, the agency responsible for pod flight scheduling, has indicated that plans are being made to launch Pod No. 1 from the Pacific Missile Range early in 1962 aboard an ATLAS missile participating in the NIKE-ZEUS Program. (S)

● The new pod schedule (2 October) has officially programmed Passenger Pod No. 6 for launch aboard ATLAS 36E in mid-December. (S)

Passenger Pod No. 6

● The prime experiment aboard this Pod is Project BIOTEL. A small primate containing a surgically implanted miniature transmitter will be placed in an environmental capsule for the flight. The transmitter will sense and telemeter physiological data during the flight. The first phases of the development of the implanted transmitter were described in the November and December 1960 Space Systems Division Activities reports. The present transmitter is of improved design, although it is still a one channel device. The physiological parameter to be measured during the flight is EKG (electrocardiogram). The objectives of the flight are to demonstrate the operational feasibility of transmitting physiological data via a surgically implanted transmitter through the intact skin of a small primate during ballistic flight and to demonstrate the adequacy of the life support system of the environmental capsule. The pod will be recovered and additional studies performed on the animal. Other experiments aboard Pod No. 6 include a radiation emulsion pack and a small radiation shielding experiment. (S)

Project BIOTEL—Environmental Capsule Description

● The capsule is a cylinder composed of two sections: the upper shell or cover which is provided with

Figure 1. BIOTEL experimental capsule with cover removed to show the two 7500 psi air tanks and the couch which will support the primate. A transducer which will sense tank pressure for telemetering during flight is mounted above the tanks. Capsule pressure and temperature and tank pressure will be telemetered, along with the primate's EKG. The air tanks provide the weight which helps to rotate the couch during re-entry, so that g-loading on the primate is in the desired direction.



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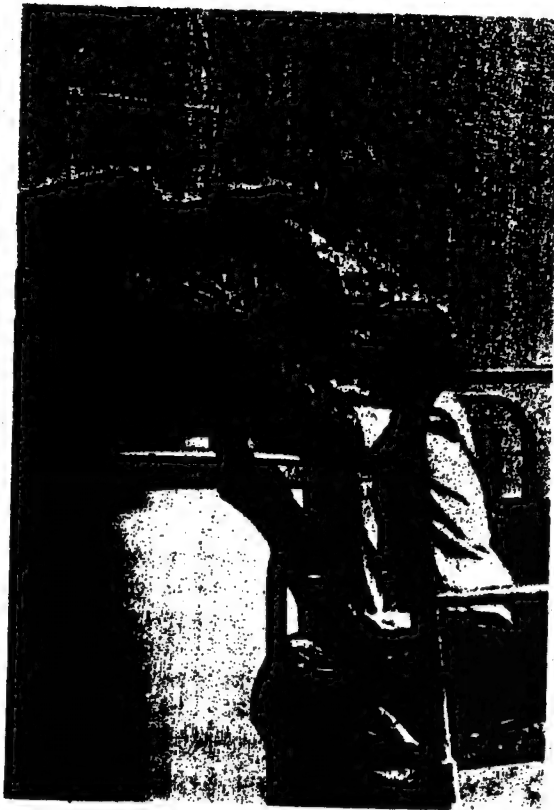


Figure 2. Preparing to lower the BIOTEL capsule into the ATLAS E pod during fit checks...lowering the capsule into the pod...installing the nose cone to complete the installation.



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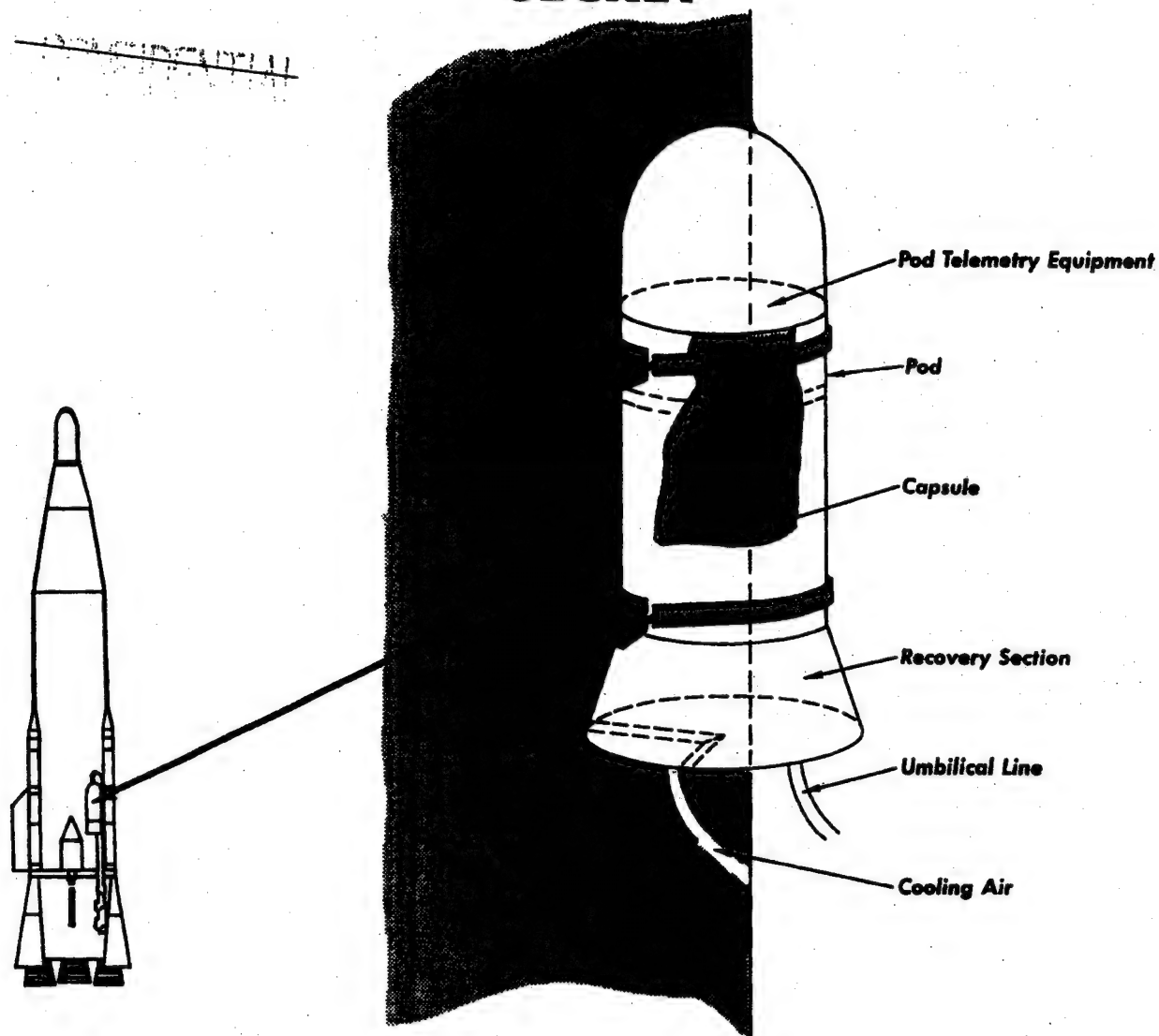


Figure 3. Schematic showing Pod No. 6 containing the capsule attached to the side of an ATLAS E missile. The cooling and umbilical lines separate at launch. The pod will be ejected from the vehicle during flight and recovered from the ocean. The recovery section contains the parachute, a balloon (for floatation), a transmitter, dye marker, and flashing light beacon.

a window for viewing the primate and the lower shell which incorporates the capsule mounting provisions and supports all the internal components. When the two segments are mated and the latching device fastened, a pressure tight capsule is formed. The capsule is designed to withstand an outside

temperature of 600° F while maintaining an internal temperature of approximately 70° F and 15 psi pressure at zero ambient pressure. The capsule is 27 inches in diameter, 30 inches high, and weighs approximately 290 pounds with full air bottles and the primate. (U)

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● The capsule air supply system is a simple high pressure type. Compressed air at 7500 psi is stored in two cylinders. This air is metered to the capsule through a regulator at a fixed flow rate which exceeds the required fresh air flow for the primate, thereby eliminating the need for carbon dioxide and moisture absorbers. A pressure relief valve maintains an internal pressure of 15 psi at all altitudes above sea level. This system also maintains the required temperature control since excess heat is carried out in the exhaust gases. (U)

● The capsule contains a couch for restraining and protecting the primate during all phases of flight. A subassembly consisting of the couch and air cylinders gimbals upon re-entry to maintain the

g-loading in a favorable direction for the primate. (U)

Arterial Blood Pressure Transducer Implant

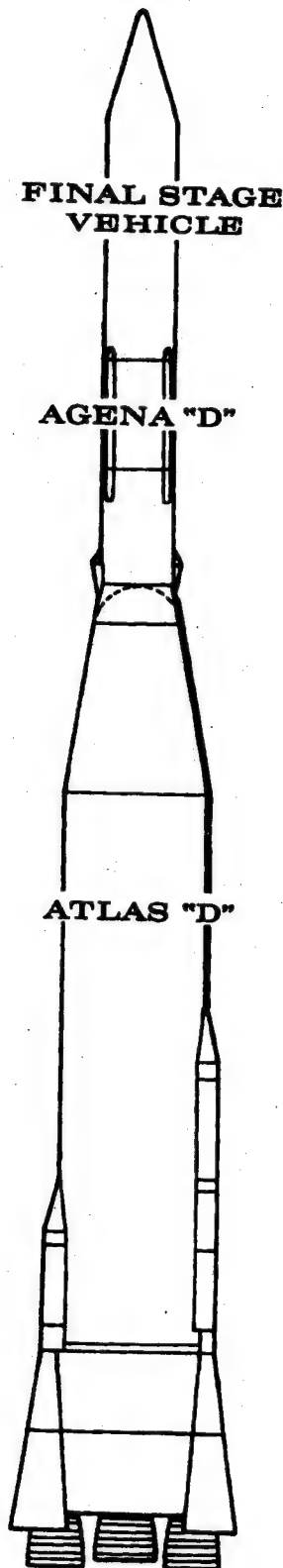
● The first surgical implant of a prototype blood pressure sensor in the abdominal artery of a dog was successfully performed on 19 September. Testing of the implanted sensor two weeks later, however, revealed that the sensor was inoperative. The sensor design was subsequently modified and a new sensor was implanted in a second dog on 18 October. It was tested shortly after implant and found to be successfully sensing blood pressure. The second dog's recovery is good. Further tests of the implanted sensor are planned before finalizing design. (U)

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SATELLITE INSPECTOR



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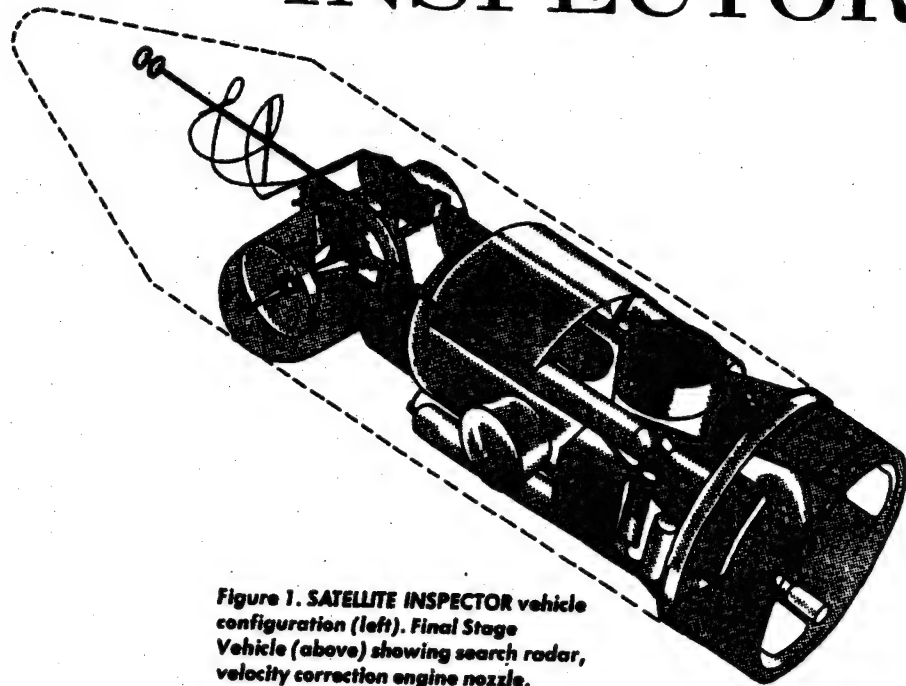


Figure 1. SATELLITE INSPECTOR vehicle configuration (left). Final Stage Vehicle (above) showing search radar, velocity correction engine nozzle, control-gas storage spheres, and attitude control jets.

The SATELLITE INSPECTOR Program has been established to develop and demonstrate feasibility of a co-orbital satellite inspector system capable of rendezvousing with and inspecting suspected hostile satellites and assessing their mission.

Program Objectives

1. Design, fabricate, and demonstrate feasibility of a prototype vehicle capable of co-orbital rendezvous with another satellite at 400 nautical miles with a capability of inspecting and identifying the unknown satellite.
2. Study and define a SATELLITE INSPECTOR vehicle which could be used as an ultimate defense vehicle having a capability of rendezvous up to 4,000 nautical miles with necessary orbit changes.
3. Develop and fabricate those long lead type items required for the ultimate defense system including a capability of negating hostile systems.

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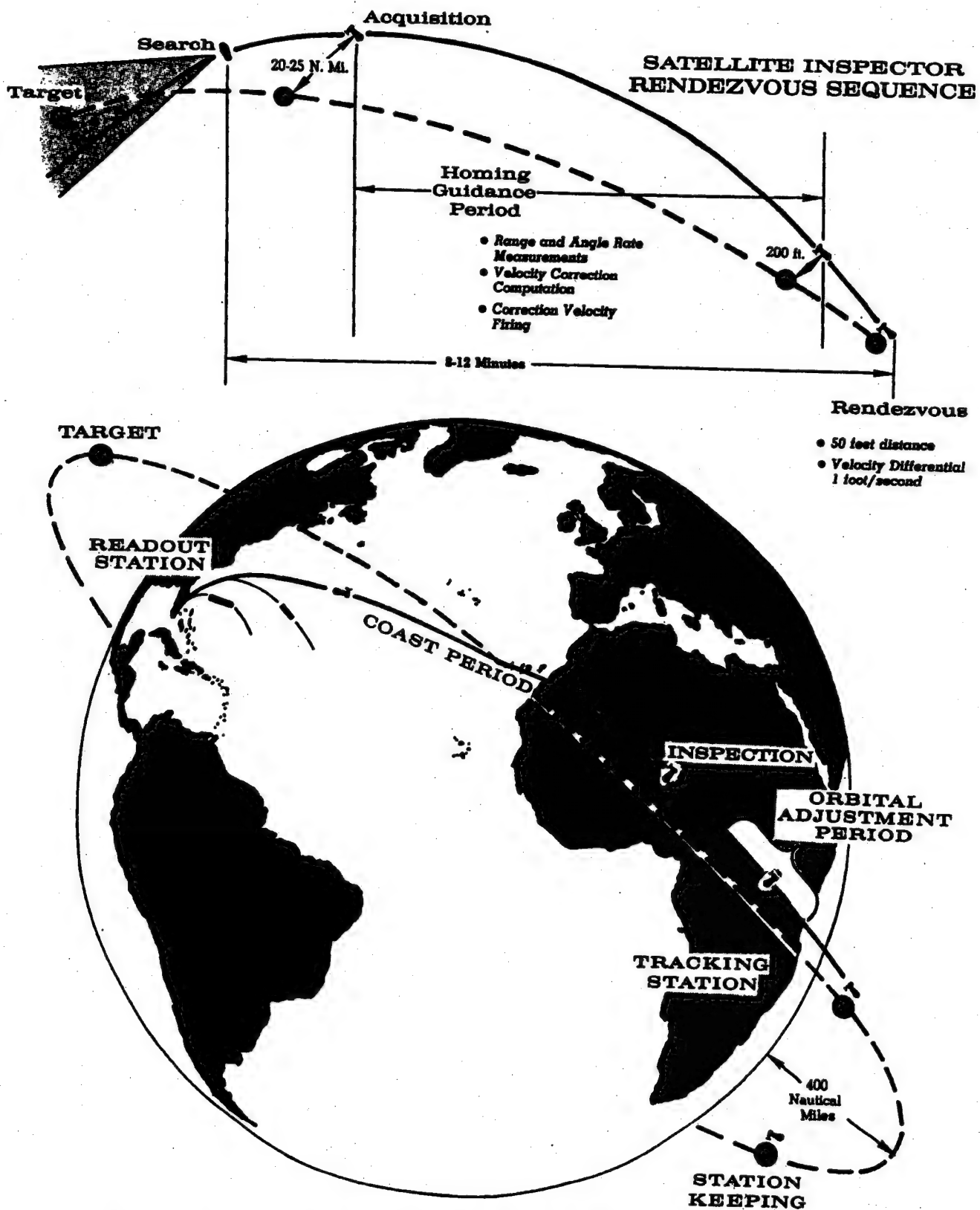


Figure 2. SATELLITE INSPECTOR Program feasibility demonstration flight and rendezvous sequence.

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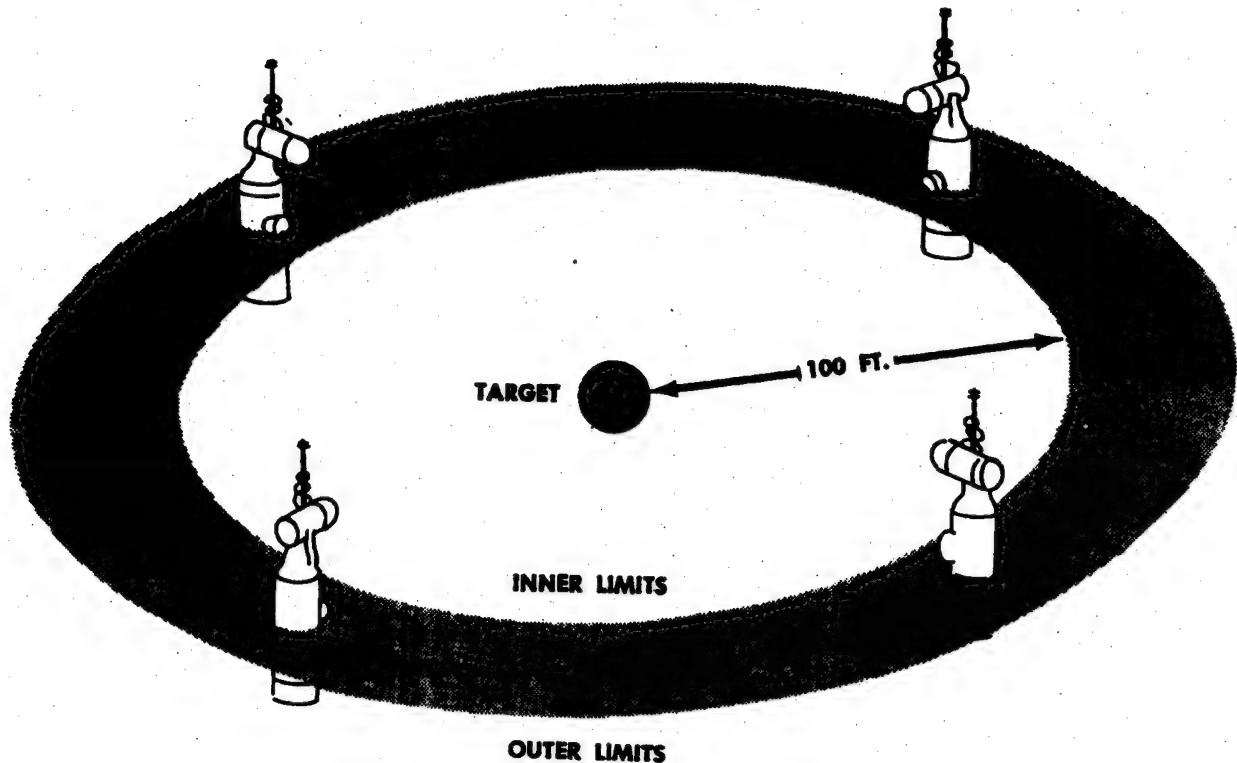


Figure 3. During station keeping, the Final Stage Vehicle will remain at a nominal distance of 125 feet from the target with the payload sensors pointed at the target. The Final Stage Vehicle will move around the target in a plane parallel to the surface of the earth at the rate of one revolution every sixteen minutes. This will permit inspection of the entire target during station keeping.

Program History

Initial studies were conducted by industry in 1958 under SR 187. Studies were continued in 1959 by the Radio Corporation of America under ARPA contract and Space Technology Laboratories under Space Systems Division management. The STL study was completed 21 December 1959 and the RCA study 31 January 1960, both indicating SATELLITE INSPECTOR would be a feasible system of practical value to the Department of Defense. Subsequently, the following actions have been taken:

1. AF System Development Requirement No. 18 published 21 April 1960
2. AFBMC approval of SATELLITE INSPECTOR Development Plan 15 July 1960
3. Department of Defense approval of Development Plan 25 August 1960
4. Air Force Development Directive No. 412 17 October 1960
5. Assigned Systems No. 621A. . 31 October 1960
6. RCA chosen as Final Stage Vehicle and payload contractor. . . 25 November 1960

7. Contract agreement with RCA 27 January 1961

8. Contract with RCA. 17 March 1961

Concept

Philosophy — The philosophy for development of the prototype vehicle calls for a step-by-step development program with a conservative choice of subsystems and emphasis upon reliability. Ground tests will provide assurance of component capability and reliability before flight.

Over-all System — Unidentified orbiting objects will be acquired, catalogued, and the ephemeris accurately determined through the facilities of the Space Detection and Tracking System (SPADATS) utilizing available acquisition and tracking equipments. (It is anticipated that, for the ultimate operational system, the capabilities of SPADATS will be expanded to provide additional information such as target size, configuration and stability in orbit, possibly within 12 hours after detection.) This information will be relayed to a Defense Command Control Center which will determine if inspection

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is necessary. Should inspection be deemed necessary, the ephemeris information will be used to compute data which will be inserted into the guidance system of a SATELLITE INSPECTOR vehicle. The vehicle will be launched into an appropriate position at a time which enables the final stage vehicle to go into orbit with the unknown satellite and inspect it at close range. This inspection data will be stored in the payload for transmission upon command to ground stations. After reception by the ground stations the data will be processed, displayed and evaluated, to determine the mission and intent of the unknown satellite.

VEHICLE:—The SATELLITE INSPECTOR system as presently envisioned, consists of three stages including an active "Final Stage" or rendezvous vehicle. Early configurations of the SATELLITE INSPECTOR vehicle will consist of a Series "D" ATLAS booster, AGENA "D" second stage, and a SATELLITE INSPECTOR final stage vehicle. This configuration is shown in Figure 1. Later final stage vehicles having increased maneuvering capability and additional sensors would be boosted with the ATLAS/CENTAUR. The final stage vehicle (Figure 1) will include a radar seeker, launch and homing guidance system, attitude control, maneuvering propulsion and a payload. The payload will include television cameras and various other sensors to determine the nature of the target satellite and its functional purpose. In addition the payload will have a storage and communications capability.

Feasibility Demonstration—Four flights launched from the Atlantic Missile Range, are planned for the feasibility demonstration. The first flight is scheduled in March 1963 with the subsequent flights scheduled at three month intervals. The feasibility demonstration configuration of the SATELLITE INSPECTOR vehicle will consist of a Series "D" ATLAS booster, AGENA "D" second stage and a SATELLITE INSPECTOR final stage vehicle. The demonstration final stage vehicle weighs approximately 2,500 pounds. In this demonstration (Figure 2), the final stage vehicle will be programmed to rendezvous with an existing satellite if one is available in a three hundred to five hundred mile easterly orbit. If such a satellite is not available, a target satellite will be placed in a 400 nautical mile, 28.8 degree inclination circular orbit by a USAF SCOUT booster. Rendezvous will be accomplished while under surveillance

of a Southeast Africa station and a TV image of the target, in addition to the telemetered data of final stage vehicle performance, will be transmitted to the ground station. The image and data will also be stored and read out on command as the vehicle passes over the Air Force Missile Test Center. For the purpose of the feasibility demonstration rendezvous is defined as a closing of the final stage vehicle with the target satellite to within 50 feet and a relative velocity of less than one-foot per second. Station keeping will be maintained for one orbital period.

Future Development—Continued study toward definition of an ultimate operational system is being pursued simultaneously with the other phases of the program. This effort will distinguish certain long lead type items on which development action must be initiated and provide further refinements to the system. Included are extension of the maneuvering capability of the vehicle into 4,000 nautical mile orbits with the necessary station keeping and inspections of multiple targets as well as more exotic sensor capability. For example, a sensor capable of detecting a nuclear warhead is most desirable. Effort is currently underway to proceed with the development of such a sensor.

Program Management

Space Systems Division management of this program is based upon the associate contractor structure composed of a First Stage contractor, Second Stage contractor, Final Stage Vehicle contractor, and Systems Engineering and Technical Supervision contractor (Aerospace Corporation). Military support is provided by the Space Detection and Tracking System through the Air Force Command and Control Development Division, and by the 6594th and 6555th Missile Test Wings.

Facilities

The demonstration program will utilize existing launch, tracking and data reduction facilities insofar as possible. However, some additional ground support equipment will be required at the Air Force Missile Test Center and at the Southeast Africa tracking site.

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MONTHLY PROGRESS—SATELLITE INSPECTOR

Program Administration

● An agreement between the Air Defense Command and the Space Systems Division concerning the target ephemeris data to be furnished by ADC to SSD in support of the SATELLITE INSPECTOR feasibility demonstration program was resolved. (S)

● Space Systems Division personnel visited Aerojet-General Corporation on 16 October to discuss the technical status of the Satellite Inspector target and to inspect some of the facilities that will be used to support the target effort. Aerojet-General personnel were briefed on the target radar reflectivities desired by Space Detection and Tracking System (SPADATA) for tracking. Potential technical problems in attaining these values were discussed, and a common understanding of these problems was achieved. Recommendations for solutions will be submitted by Aerojet after preliminary testing of reflectivity values over various radar frequencies. (U)

● Radio Corporation of America has completed an advanced system study. The report is due 30 Novem-

ber 1961. Work at Aerospace Corporation on a similar study is still in progress. (U)

Technical Progress

● Assembly of a breadboard SATELLITE INSPECTOR prototype payload has been started by RCA for development and evaluation testing. (S)

● Fabrication of the Final Stage Vehicle ascent fairing was started by Douglas Aircraft on 20 October. AVCO has started fabrication of the Final Stage Vehicle structure. (U)

● Radio Corporation of America has established a sub-contract with American Electronics to supply the solid state inverters to be used for the Final Stage Vehicle power supply. (U)

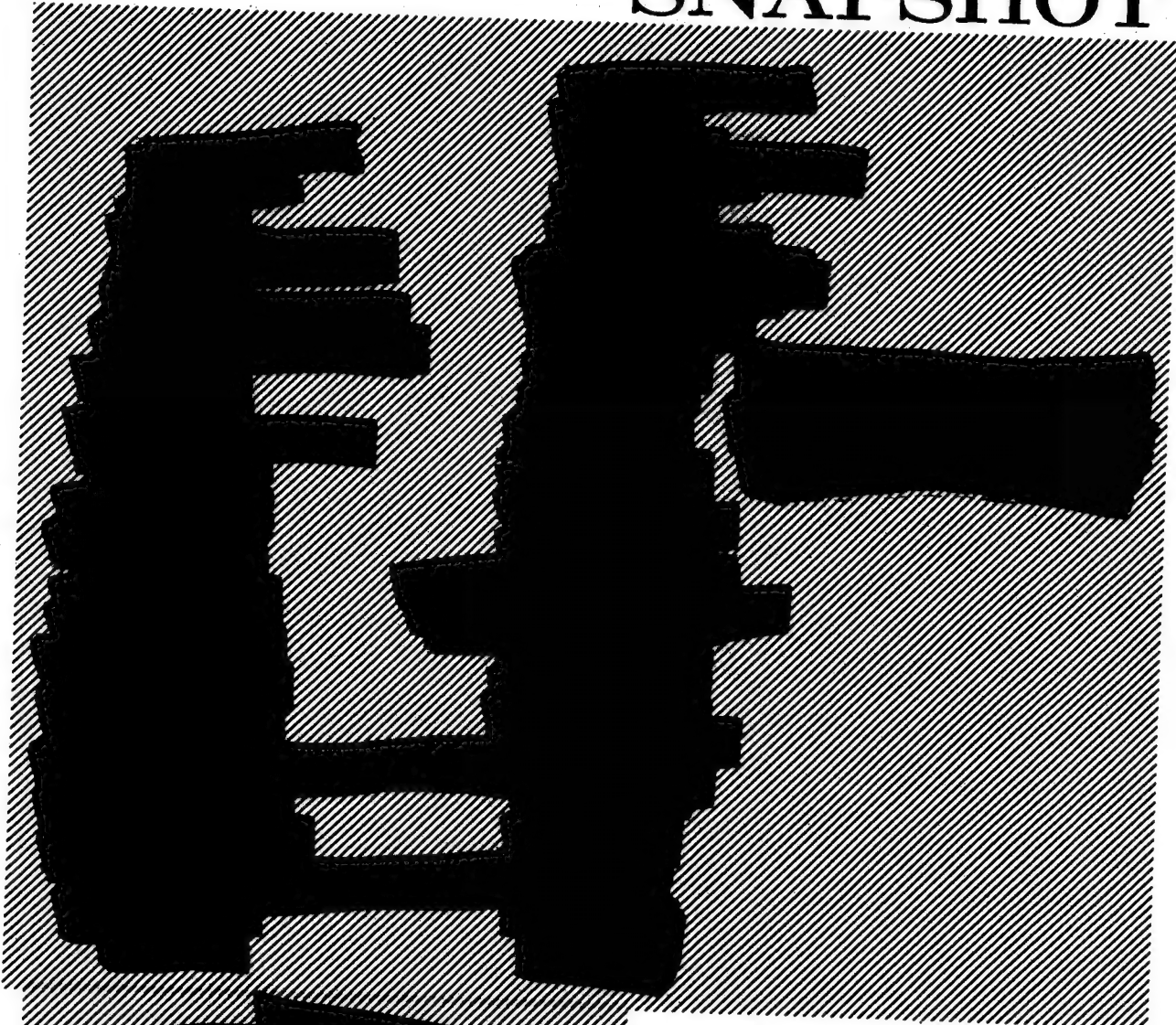
Facilities

● The final design review conference for the modifications to Atlantic Missile Range Launch Complex 13 is scheduled for 15-16 November. The design is proceeding toward meeting a contract award date of 8 January 1962 based on present estimates of stand availability. (U)

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SNAPSHOT



Objectives

For the SNAPSHOT Program the Air Force will provide ATLAS D/AGENA D vehicles, launch facilities, data acquisition and reduction, and system integration for the on-orbit testing of two Atomic Energy Commission developed Subsystems for Nuclear Auxiliary Power (SNAP). These SNAP units are being developed to meet space system requirements in the low-kilowatt range. They will precede larger, more complex systems which will provide up to several megawatts of power. Payloads representative of anticipated applications will be provided by the Air Force and operated on orbit to demonstrate their compatibility with the SNAP units. Additional secondary scientific and engineering payloads may be flown providing the primary mission is not placed in jeopardy.

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History

The Atomic Energy Commission Program to develop Subsystems for Nuclear Auxiliary Power (SNAP) was initiated in 1956 in response to Air Force identified requirements for long duration auxiliary power in earth satellite reconnaissance systems. In mid-1957 a joint AFBMD/AEC SNAP Coordination Committee was established with the approval of General Schriever, AFBMD, and General Keim, AEC. The purpose of this committee was to coordinate the SNAP activities of AFBMD and AEC and make recommendations on matters pertinent to Development Programs.

The need for nuclear auxiliary power flight testing was recognized by Hq USAF in March 1960. The Abbreviated SNAPSHOT Development Plan was submitted on 14 June 1960. Approval by Hq USAF and the Department of Defense was granted on 27 December 1960 and Atomic Energy Commission concurrence followed on 7 March 1961. Subsequently, the following actions have been taken:

1. SNAPSHOT Proposed Advanced Technology Program Plan published 17 April 1961
2. AF Advanced-Development Objective No. 28 issued 4 May 1961
3. Prime Contract Award to LMSC 17 June 1961
4. AF Development Directive No. AT-1 issued 28 June 1961
5. Assigned Advanced Development No. 660A 14 August 1961

Reactors

The SNAP 10A and SNAP 2 auxiliary power systems being developed by the Atomic Energy Commission use the same basic nuclear reactor as a heat source and employ a liquid metal heat transfer loop to the converter. The SNAP 10A generates 500 watts with a static thermoelectric converter and the SNAP 2 generates three kilowatts with a dynamic turbine-alternator. SNAP 10A has been conceived and designed for MIDAS applications and will be used in advanced versions of that system if proven in SNAPSHOT tests. Both units will be designed to minimize radioactive hazards. Among the advantages of the SNAP systems as opposed to solar power supplies is their ability to provide power during prolonged eclipses, the 350-hour lunar night, and at great distances from the sun. Electrochemical

and/or thermal energy storage devices can be eliminated from nuclear systems if they prove to be unreliable, whereas such devices are vital to solar power units. Furthermore, nuclear power units do not require vehicle orientation and stabilization as do solar supplies.

Radiological Safety

The Atomic Energy Commission, by law responsible for reactor safety during development, will share with the Department of Defense the responsibility for safety through the flight testing period. The operating agencies will pursue radiological safety as a range safety matter. The Air Force Special Weapons Center has been assigned Air Force responsibility for radiological safety and will provide direction to LMSC in preparation of an Operational Safety Plan. SNAPSHOT payloads must be injected into circular orbits exceeding 600 nautical miles for radiological safety reasons. This orbit will insure an orbital lifetime of 200 years. By that time the material produced during reactor operation will have decayed to safe levels before vehicle re-entry occurs. The reactor will not be started until it is on orbit and it has been determined that a sufficiently long orbital life is assured.

Management

Lockheed Missiles and Space Company has been selected by the Space Systems Division as the prime system contractor. They will be responsible for the AGENA D satellite vehicle and for general systems engineering and technical direction. General Dynamics-Astronautics, an associate contractor, will provide ATLAS D boosters and launch services. The Atomic Energy Commission Division of Reactor Development has selected Atomics International to develop, ground test, and produce the nuclear reactors. A joint advisory committee will coordinate activities and identify interface problems.

Facilities

A launch site facility required by Atomics International, the AEC payload contractor, for checkout of SNAP units prior to delivery in flight-ready condition will be provided by the Air Force. This may be regarded as a non-nuclear facility, since on-site reactor operation will be unnecessary. Post delivery SNAP/AGENA mating and checkout will be accomplished by LMSC.

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LAUNCH SCHEDULE

1963												1964											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		1			1									1						1			
SNAP 10A												SNAP 2											

MONTHLY PROGRESS—SNAPSHOT

Program Administration

● The SNAPSHOT Joint Working Group met at Atomics International (AI) on 4 and 5 October. The Joint Working Group is composed of representatives from the Space Systems Division, the Air Force Special Weapons Center (AFSWC), the Atomics Energy Commission (AEC), Lockheed Missiles and Space Company (LMSC) and Atomics International (AI). Among the items discussed at this meeting were nuclear safety, siting of the SNAP Prelaunch Test Facility, interface problems, and the LMSC/AI need dates for delivery of test and flight hardware. Since these two companies are interdependent, the delivery schedules are extremely important. Single points of contact were established at both LMSC and AI to represent each company on interface problem areas. Coordination of AI and LMSC inputs for the Preliminary Safety Report was scheduled for early in November. Siting of the test facility is contingent upon clarification of AEC and USAF Deputy Inspector General for Safety positions regarding safety measures. (U)

● A Program Authorization was received for the balance of the FY 62 funds identified to date. Approval action is still pending on the additional funds needed to satisfy FY 62 requirements. (U)

● The Space Systems Division submitted secondary payload proposals to LMSC on 12 October and 30 October for evaluation prior to the secondary payload screening conference scheduled for mid-November. (U)

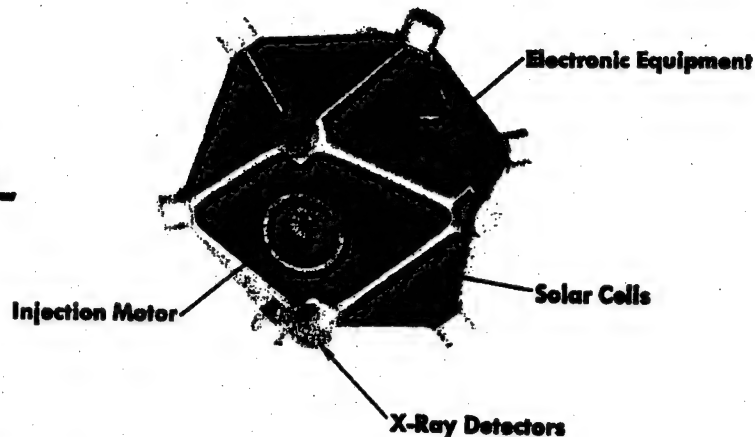
● Space Systems Division and Lockheed Missiles and Space Company representatives reviewed the SNAPSHOT Preliminary Work Statement on 20, 24 and 25 October. A second series of meetings will be held at LMSC on 1 and 2 November and a date will be established for re-submission of the Work Statement. (U)

Facilities

● Authority to start design of the SNAP Prelaunch Test Facility was received on 13 October. A remote site on Vandenberg Air Force Base has been selected and the Architect-Engineer (Norman Engineering Corp) design effort was started on 25 October. Final design submittal is scheduled for 10 January 1962. (U)

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VELA HOTEL



Program Objectives

The objective of the VELA HOTEL Project is to conduct a research and development program including experiments and prototype testing to gain information which will lead to the definition of an operational space-based system for high altitude nuclear detonation detection.

Program History

The Panofsky Panel on High Altitude Detection, reporting to the President's Scientific Advisory Committee, made several recommendations with respect to research and development work which should be accomplished in order to increase basic understanding of the physical mechanisms involved. The Department of Defense agreed to assume over-all responsibility with Atomic Energy Commission support in the high-altitude detection area. Further, it was agreed that the AEC would undertake laboratory development of the nuclear detection instrumentation and that the portion of the effort concerning measurements of natural radiations in space should be implemented jointly by the DOD and the NASA. Within the Department of Defense, the Advanced Research Projects Agency was assigned the management responsibility for Project VELA on 2 September 1959. On 18 September 1959, ARPA issued Order Number 102-60 to AFSC for a study and evaluation of the technical and operational factors associated with the detection of high-altitude nuclear detonations. The initial results were used in October 1959 to provide the State Department with supporting technical data for the United States delegation at the Geneva conference. Amendment No. 1 to the original ARPA Order directed AFSC to extend and refine the original study. It was subsequently requested that a joint working group including AFSC, AEC and NASA representatives, chaired by AFSC, be established. The mission of the Joint Working Group was to recommend a research and

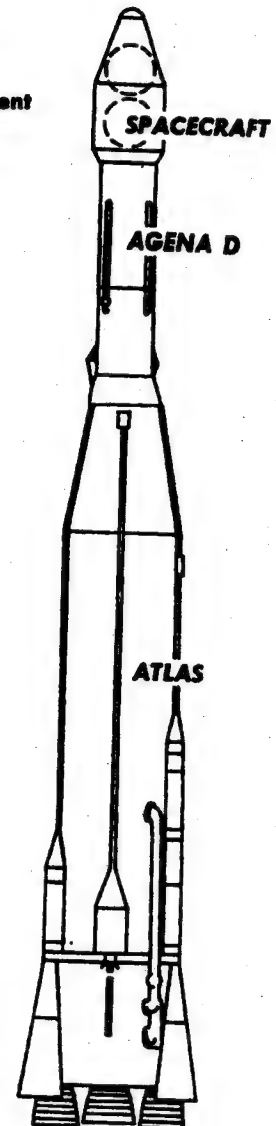


Figure 1. VELA HOTEL vehicle configuration (right). Artist's concept of payload showing solar cells, X-ray detectors and injection motor.

development program which would investigate the concept of nuclear detonation detection from satellites. To facilitate conducting the work involved, the Joint Working Group formed subcommittees for payload, space boosters, and communications and control.

Program Concept

On 21 June 1961, the Secretary of Defense approved and funded the VELA HOTEL Program. The program will consist of five launches from the Atlantic Missile Range, beginning in April 1963 and extending through April 1964.

The launch vehicle for the VELA HOTEL Program will be an ATLAS D/AGENA D. Each vehicle will place two spacecraft into a single highly elliptical orbit. The instrumentation aboard the spacecraft will be furnished by the AEC and will consist of X-ray,

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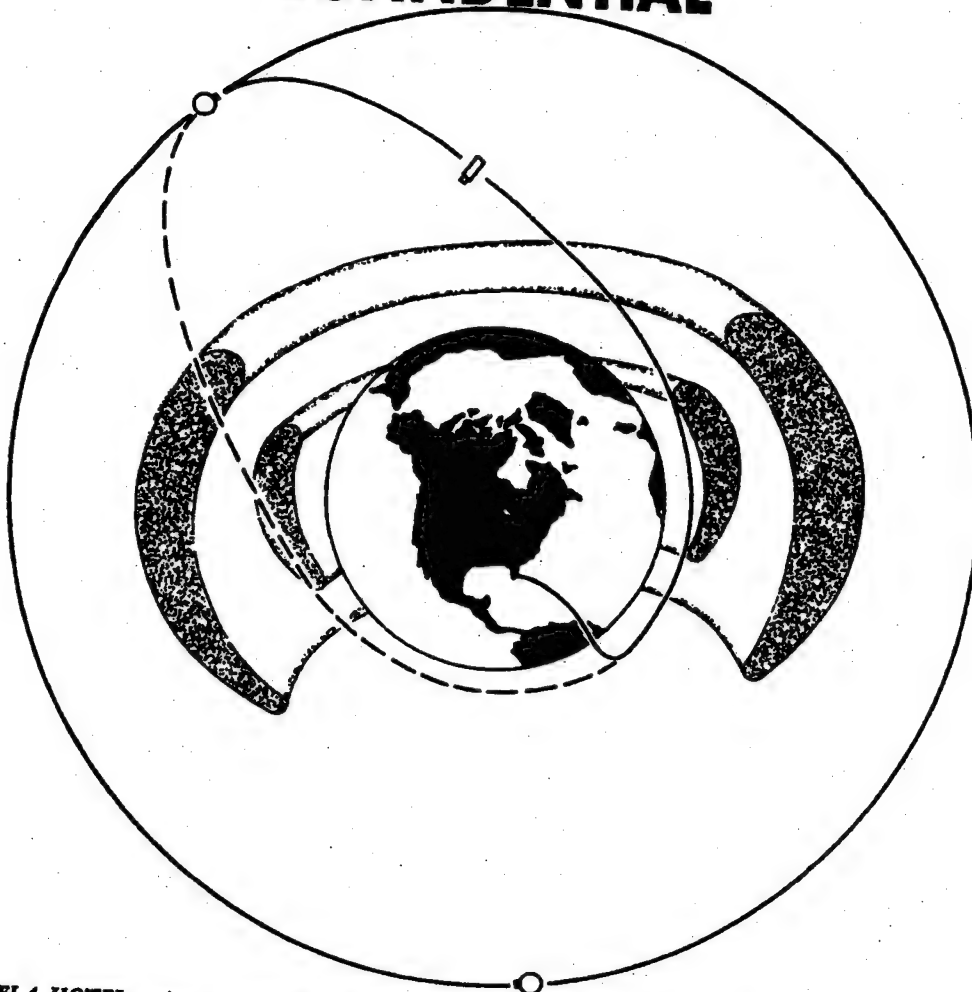


Figure 2. VELA HOTEL trajectory showing the elliptical transfer orbit which has a 200 n.m. perigee and a 50,000 n.m. apogee. On the first orbit one payload will be ejected, on the next orbit, the second payload will be fired and placed into orbit approximately 140 degrees behind the first payload.

gamma ray, and neutron detectors and Geiger-Mueller tubes. Each spacecraft will contain a propulsion unit capable of transferring the spacecraft into a minimum circular orbit of 50,000 nautical miles. The propulsion unit of one spacecraft will be fired at first apogee and the second spacecraft will be transferred at a later apogee such that the spacecraft will initially be 140° apart in orbit. The spacecraft will be designed to have an operating life of six months with redundant telemetry transmission capabilities in range of 75,000 nautical miles.

The vehicle will be launched from the Atlantic Missile Range at an azimuth of approximately 110° . After AGENA D separation from the ATLAS D, the AGENA D will program through two burns with final cutoff over Australia. A spin table on the AGENA D will then spin and separate the tandem payloads. The two spacecraft will then separate such that at apogee they will be several miles apart. The previously described transfer sequence will then be initiated.

Simultaneous tracking of the two spacecraft will be carried out by the SSD world wide tracking net. Data will be collected at Sunnyvale Satellite Test Center, punched on tape and shipped to the AEC at Albuquerque, New Mexico for reduction and analysis.

In addition to the major high-altitude portion of the VELA HOTEL Program, several Discoverer piggy-back low altitude polar orbit flights are being accomplished which will obtain background radiation data below the Van Allen belts. These flights carry Lawrence Radiation Laboratory experiments consisting of X-ray, gamma ray and neutron detectors, PENG (proton-electron-neutron-gamma ray) detectors and solid state spectrometers.

The AEC is also initiating, as a separate but related project, a piggy-back flight program aboard Rangers (Lunar probes), NASA Scouts and Mariners (Venus probes).

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MONTHLY PROGRESS - VELA HOTEL

Program Administration

● The initial VELA HOTEL launch has been rescheduled for May 1963 because of the delay in selecting the Spacecraft contractor. This represents a one month delay in the program. (C)

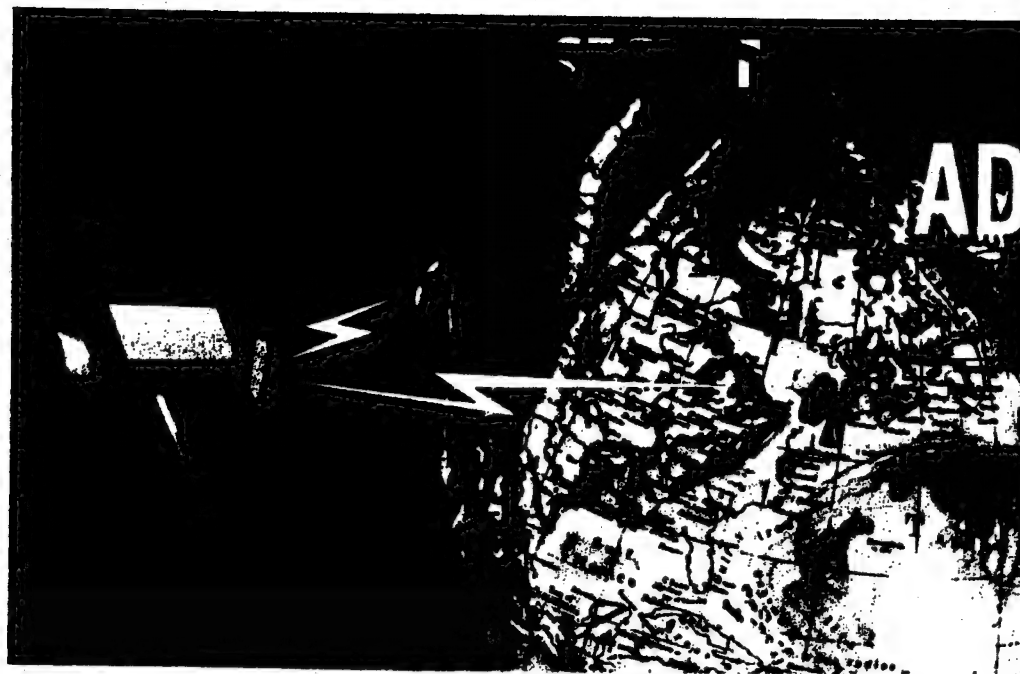
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LAUNCH

VEHICLES



ADVENT
ANNA
BLUE SCOUT
DYNA SOAR
MERCURY
RANGER-NASA AGENA "B"
TRANSIT

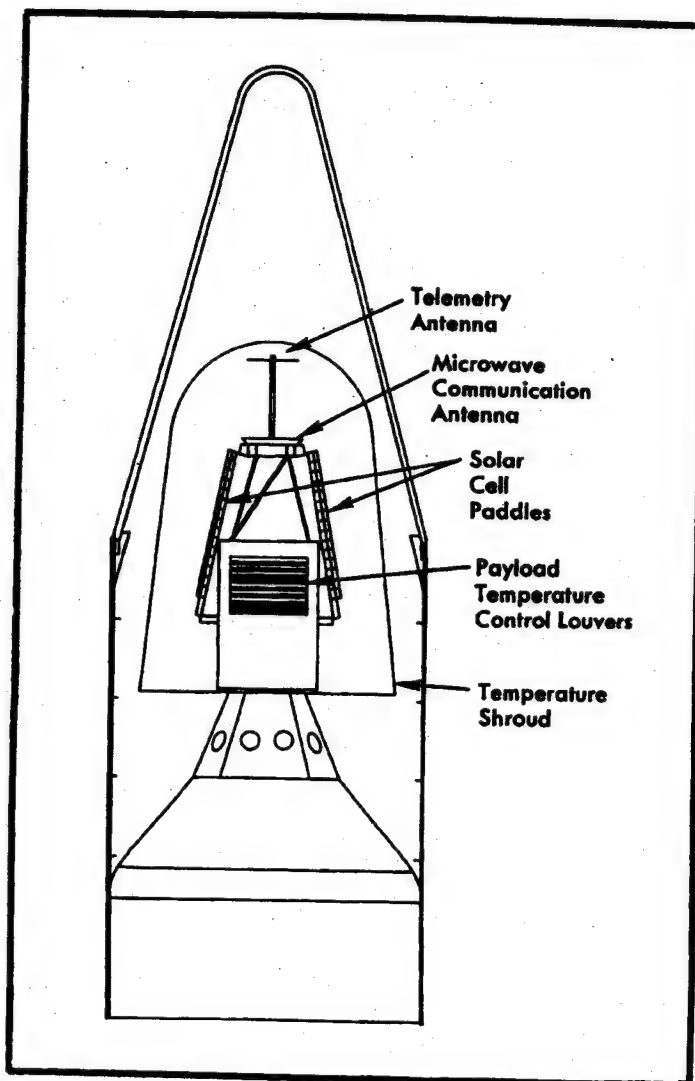


The ADVENT Program will investigate the feasibility of using satellites in synchronous orbit as instantaneous repeaters for microwave radio communications. A satellite vehicle station in synchronous equatorial orbit will remain in a fixed position relative to any point on the surface of the earth. Active communications equipment contained in this satellite will receive, amplify and instantaneously retransmit messages beamed in its direction.

PROGRAM HISTORY

The Research and Development program for active communication satellites was initiated by ARPA in January 1959. Following early research and development, a three-phased development program (STEER, TACKLE and DECREE) was initiated in May 1959 by Amendment No. 1 to ARPA Order No. 54. Phase I (STEER) was given priority in order to demonstrate the feasibility of providing an early UHF communications capability for positive control of the SAC strike forces. Space Systems Division (SSD) was given responsibility for the design, development, and flight testing of the complete system, including launch, satellite tracking and control, and necessary support facilities and ground equipment. Aeronautical Systems Division (ASD) and the U.S. Army Signal Research and Development Laboratory (USASRD) were delegated responsibility for the development of the communications subsystem for Phase I and Phases II and III, respectively.

Figure 1. Proposed satellite with jettisonable fairing mounted on CENTAUR second stage.



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In April 1960, Amendment No. 5 to ARPA Order No. 54 reoriented the program. The research and development effort previously directed toward providing a ground-to-satellite-to-aircraft UHF communications capability for the SAC strike forces was cancelled. A single integrated ADVENT Program for the development of a 24-hour microwave communications satellite replaced the former STEER, TACKLE and DECREE Programs.

On 15 September 1960, the Secretary of Defense transferred over-all management responsibility for the ADVENT Program from ARPA to the Department of the Army. The development responsibilities of SSD and USASRD were retained essentially status quo. The Army was given responsibility for funding and for over-all systems engineering to provide guidance and a basis upon which detailed design data can be evolved by SSD and USASRD.

PROGRAM OBJECTIVES

The primary ADVENT objective is to demonstrate the feasibility of achieving a military system for microwave communications (surface-to-surface) employing satellite repeaters in 24-hour equatorial orbit. The feasibility of placing a satellite in predetermined

position in a 19,300 nautical mile equatorial orbit must be demonstrated. The feasibility of being able to stabilize the satellite, control its attitude and orbit, and keep it on station within the required tolerances must also be demonstrated. The satellite must be capable of providing broad band communications on a real time basis at microwave frequencies. The Program Plan is based upon the design of a single configuration of a final stage vehicle compatible with launching by either AGENA "B" or CENTAUR second stage boosters.

The ADVENT Program will consist of the following flight tests, launched from the Atlantic Missile Range:

Phase One. Three ATLAS/AGENA "B" flights, nominal 5,600 nautical mile orbits, beginning March 1962.

Launch Schedule

	1962												1963*												1964*				
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M
			1			1			1																				
Launch Vehicles provided by	ARMY																												
Vehicle Configuration	ATLAS/AGENA "B"																												

*A revision of the 1963 and 1964 portion of the launch schedule is now under study.

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MONTHLY PROGRESS—ADVENT

Technical Progress

Booster Vehicles

ATLAS

● Fabrication of ATLAS 122, the first ADVENT booster, has been completed. The booster is currently undergoing a quality assurance inspection prior to starting final system checkout. (C)

● Flow testing of two different liquid oxygen tank step pressure systems has been completed by General Dynamics-Astronautics. ATLAS liquid oxygen tank pressure will be between 23.6-26.0 psig up to T+20 seconds and will then change to 28.5-31.0 psig for the remainder of the flight. This type of two-stage pneumatic pressurization is necessary to insure that the structural integrity of the ATLAS booster will be capable of meeting ADVENT structural design requirements without danger of intermediate bulkhead reversal caused by over-pressurization of the liquid oxygen tank. (C)

CENTAUR

● The work statement, defining the RL10A-3 engine development program required to meet ADVENT Program requirements, was completed and forwarded to USAAMA on 4 October. (U)

● One copy of the technical portion of the revised ADVENT/CENTAUR proposal has been obtained from General Dynamics-Astronautics and is currently being reviewed by the Aerospace Corporation. Additional copies of the technical proposal were delivered on 3 November. A submission date for the cost proposal has not yet been established. (U)

AGENA

● AGENA vehicle 1501 (ADVENT 1) was delivered to the Santa Cruz Test Base on 20 October. This second stage vehicle is scheduled to start hot firing tests on 16 November. (C)

● Nose-fairing separation testing was completed on 5 October. A failure was encountered during the first separation test. Investigation revealed that insufficient clearance between the positioning pin and its receiving device was the cause of the failure. Design changes were made which resulted in eighteen successful separations. (C)

● Wind tunnel testing is proceeding on schedule. The Langley transonic phase of testing was completed

on 20 October. The models were shipped to the Lockheed Supersonic Facility at Rye Canyon where testing started on 16 October. It is anticipated that this phase of testing will be completed by 24 November. (U)

● Procurement action has been initiated by Lockheed Missiles and Space Company for the materials and components to satisfy the requirement for a second stage destruct system. The initial design studies for the destruct system are complete with the detailed design approximately 60% finalized. (U)

Final Stage Vehicle

● New vibration and acceleration levels, based on launch data obtained from other space programs, which may be encountered during launch make it necessary to test OTV-1 at vibration and acceleration levels considerably higher than the original design levels. At the October Technical Direction meeting, the following test plan was established:

1. The Dynamic Test Vehicle (DTV) will be tested to the original design acceptance levels. Following the successful completion of these tests, flight test proofing at the higher levels will be accomplished. While the accumulated test time on this vehicle may compromise the significance of failures encountered during the flight proofing, such failures will be considered sufficient reasons to initiate modifications to the OTV-1.

2. If the DTV satisfactorily completes the flight proofing test, the OTV-1 will be acceptance tested to the higher test levels. If a DTV failure occurs, the mode of failure and the extent of modifications will be evaluated to determine whether the DTV should be modified and the test continued or the test terminated and another structure diverted from its intended use and used for further dynamic testing.

3. If a structural failure occurs during the acceptance tests, it will be mandatory that the required design modification be made and incorporated into the OTV-1. If a component failure is experienced, an evaluation will be made to determine the course of action. (U)

● The following problem areas which may adversely affect the OTV-1 delivery were presented at the October Satellite Subsystem Technical Direction Meeting. Representatives from USAAMA, Space Systems Division, Aerospace Corporation, and General Electric-Missiles and Space Vehicle Department were in attendance. (U)

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UNIT	PROBLEM	SOLUTION
Temperature Controller Assemblies	Need date: week ending 8 December Available: week ending 29 December	Use temporary aluminum temperature panels until vendor flight panels are available.
IR Horizon Scanner	Need date: week ending 8 December Available: week ending 19 January 1962	Use first two units manufactured for OTV-1 which had been scheduled for use as engineering development models.
Signal Data Converter	Need date: week ending 8 December Available: week ending 19 January 1962	Use first engineering unit.
Radiation Assembly	Need date: week ending 24 November Available: week ending 26 January 1962 Problems are in the ionization chamber, the 700 volt power supply, and the electron spectrometer.	Omit from OTV-1, if not available.
Commander Decoder	Need date: week ending 1 December Available: week ending 22 December	Use breadboards for systems tests.
General Electric Satellite Simulator	A delivery date slippage of this unit will adversely affect the delivery and checkout of Philco delivered Ground Stations	AFSSD has called a meeting to be held at General Electric, Philadelphia, with Philco (WDL) to determine the possibility of reducing the time required to check out the ground station. If a solution cannot be found, the GE slippage will result in a day-for-day slippage for Philco.

● Space Systems Division has recommended the liquid flywheel be incorporated. USAAMA is presently reviewing the data supporting this recommendation. A recommendation concerning development of an electronic infrared horizon sensor will be made later. Favorable recommendation is dependent upon GE-MSVD providing solutions for several major deficiencies in the proposed system. (U)

● Representatives from Aerospace, GE-MSVD, and the Space Systems Division attended a propulsion subsystem review at Marquardt on 10 October. Because of the test results of four firings under vacuum conditions, the problem of nozzle life was discussed. Two nozzles encountered burnout after 21 and 28 minutes operation and two operated for over 50 minutes with no burnout. The burnout was believed to have been caused by a failure to achieve a smooth surface prior to coating. Marquardt is studying the problem and striving to improve the nozzle quality control. (U)

● Because of Marquardt delivery problems, the two OTV-1 propellant tanks will be sent to General

Electric with no acceleration, burst, or vibration tests. The next two tanks manufactured will be sent to a testing laboratory for these tests. (U)

● General Electric recently proposed a redesign of the Final Stage Vehicle to meet the specification weights. Based on the current weight estimates and the amount of weight saved in comparison to costs, a recommendation not to redesign was presented to USAAMA. USAAMA concurred in this decision. (U)

Tracking, Telemetry, and Command

● Representatives of the Space Systems Division, GE-MSVD, Aerospace and the National Security Agency attended a TT&C design review on 3 and 4 October. The TT&C design, components, tests, problem areas, and schedule status were reviewed. (U)

● The requirements for having ground command tone filters and relaxing the residual command modulation from 0.1 radian on the FSV transmitted signal are being reviewed. The possibility of using airborne TT&C equipment with RADOP is also being studied. A need was recognized for establishing incidental phase modulation for the airborne and ground tracking system. A study is currently being

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conducted to determine a value. The vehicle system engineering contractor is considering the use of airborne telemetry filters with the FSV's and the OTV. (C)

● A technical design and development status review of the TT&C RF subsystem and antenna was conducted during the period of 9 through 13 October. All of the potential design problems were explored in detail with engineering personnel at Philco WDL, Sierra Electronics, Motorola Corporation, and Canoga Corporation. While much of the information will be used in further analysis of the equipment design, no technical direction was given to Philco WDL. (U)

● An investigation and analytical study was conducted to determine if the lobing switch used in the Fort Dix and Camp Roberts antenna subsystem would degrade system performance. The switch is a rotating probe capacitively coupled to each of the four input probes. For 30° during each rotation the probe is between poles. This open circuit is reflected back into the comparator network and ahead to the filters and parametric amplifier. When the probe is coupled to one pole, an open circuited condition from the other three poles is reflected back to the comparator network and a mismatched condition is reflected to the preamplifier. Discussions with Sylvania personnel indicate that they realize the mismatched condition will exist but do not consider this a problem area. They maintain empirical data obtained from actual tests will show minimal system degradation. Upon receipt of actual test results from Sylvania, a further evaluation will be made. (U)

Systems Test

● The Launch Test Plan has been completed and approved by USAAMA. (U)

● Revision 4 of the Launch Program Requirements Document No. 1600 has been completed and published in draft form. Meetings have been held with the associate contractors regarding the inputs and associate contractor coordination has been completed. This document is undergoing USAAMA review and upon approval will be published in final form. (U)

● A request for an AGENA stage destruct system waiver was forwarded to the 6555th Aerospace Test Wing, Patrick Air Force Base, on 27 October. (U)

● The Laboratory for Electronics is translating the STL AT4Z tracking program from IBM 7090 to CDC 1604 language. The latest AT4Z modifications are being added and changes are being made to adapt this program to meet ADVENT requirements. Target

date for the complete tracking program is 31 December. (U)

● Philco is responsible for programming the computers at the TT&C stations to perform the required data scanning and formatting for command processing. The telemetry module is coded and is being checked. Completion is expected by 15 November. The command process module is also coded and is being checked. Completion is expected by 10 November. Combination of these two modules is expected by 24 November. The program will be operational by 15 December. On-site integration of the programs into the TT&C station computers will be accomplished by February 1962. (U)

Facilities

● Requirements for modification of the ethylene oxide storage area for pre-launch inspection, repair, checkout, and flushing of the ADVENT Final Stage Vehicle propulsion system were finalized on 12 October. Design criteria has been completed and forwarded to USAAMA for placement of contracts through the Jacksonville District Corps of Engineers. (U)

● Modification of Hangar AA to support General Electric and Bendix pre-launch servicing and checkout operations is proceeding on schedule. The problem of providing mounts for the Bendix antennas was resolved by the decision to utilize antennas of four-foot and six-foot diameters at Hangar AA. (U)

● Detailed planning for modification of Atlantic Missile Range Launch Complex 12 has been initiated. Lockheed Missiles and Space Company has been designated as the integrating contractor for the accomplishment of this task. Meetings to establish milestone schedules and prepare modification plans were held at Patrick Air Force Base during the week of 23 October. (U)

● All work on Launch Complex 36 facility modifications for Phase III launches has been suspended pending resolution of Phase III vehicle configurations and launch schedule problems. (U)

● Representatives of the Space Systems Division, 6594th Aerospace Test Wing, Aerospace Corporation, Philco, GE-MSVD and LMSC visited the Kaena Point tracking station during the week of 15 October. Detailed discussions on all phases of ADVENT support were held. The major problem area remaining to be resolved is lack of adequate operation and maintenance space. Detailed justification for an addition to the VHF building is being prepared and will be resubmitted to USAAMA in the near future. (U)

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Project

ANNA

Second Stage -- ABLESTAR (AJ-10-104)

Thrust (vacuum)	7900 pounds
Specific impulse (vacuum)	277 seconds
Burning time	296 seconds
Propellant	IR FNA UDMH

First Stage -- DM-21A

Thrust (sea level)	152,000 pounds
Specific impulse (sea level)	247 seconds
Burning time	163 seconds
Propellant	Liquid Oxygen RP-1

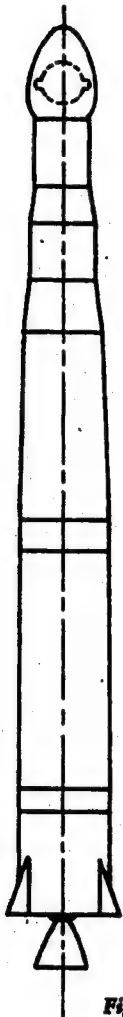


Figure 1. Two stage ANNA vehicle.

Program Description

Project ANNA is the tri-service geodetic satellite program. The program is designed to satisfy the primary military (Army, Navy, Air Force) and scientific (NASA) requirements in geodesy. The Navy has over-all program management responsibility and is also responsible for satellite system management. The Space Systems Division (SSD) was assigned the responsibility for booster system management, which includes providing the booster vehicles, integrating payloads to the vehicles, and being responsible for flight operations from launch through attainment of orbit. On 4 April 1961, the Navy officially directed the Space Systems Division to proceed with plans for launching the first ANNA satellite on 5 December using the THOR Ablestar (Figure 1) vehicle previously purchased for TRANSIT 5A. This has subsequently been rescheduled for 6 March 1962.

Payload Description

The ANNA payload (Figure 2) is a 36-inch diameter sphere with a bank of solar cells encircling the package at the equator. The satellite contains an Air Force High-Intensity Pulsed Gas Discharge Lamp for optical measurements, a Navy (TRANSIT) doppler beacon for doppler measurements, and an Army SECOR Transponder for radio ranging data. The basic payload structure is the same as the TRANSIT Navigational Satellite. The payload weight is 350 pounds. The payload contains high magnetic permeability rods which will reduce the satellite spin to zero by hysteresis damping after a few days on orbit.

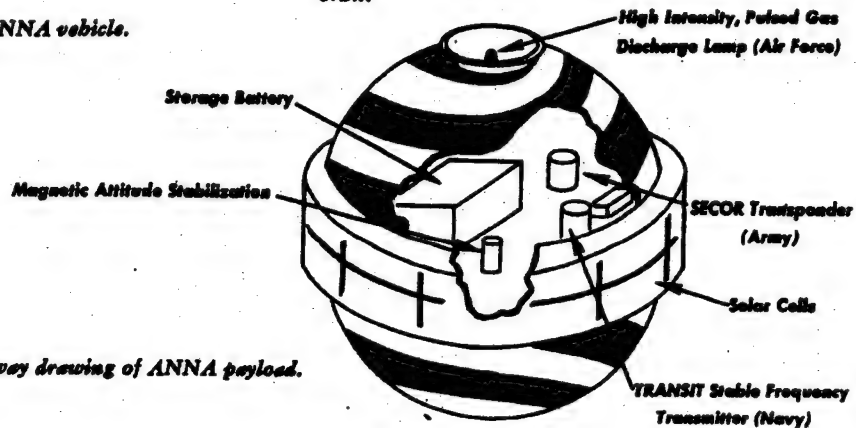


Figure 2. Cutaway drawing of ANNA payload.

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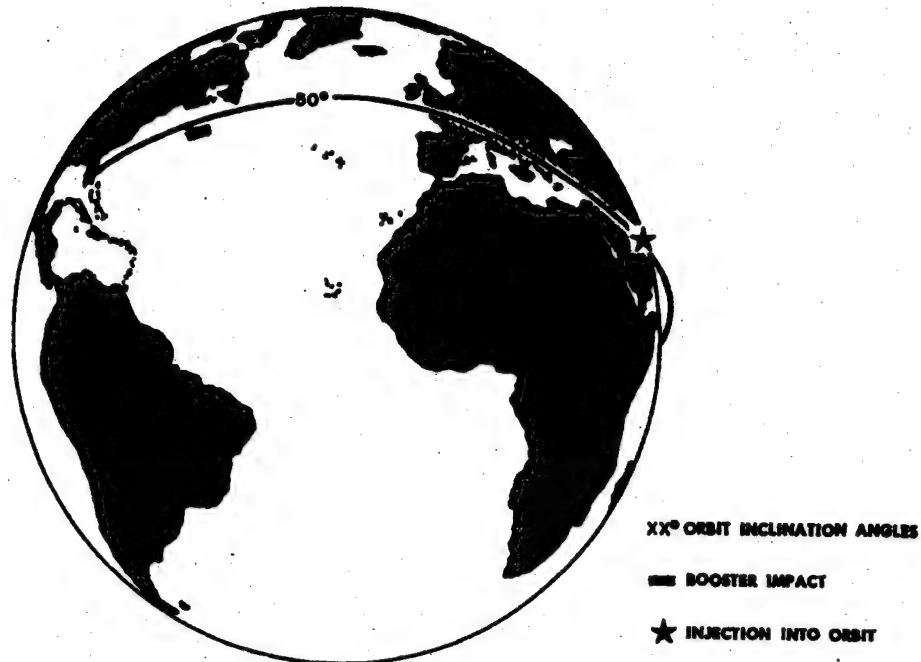


Figure 3. ANNA launch trajectory (50° orbit inclination angle) showing flight path, booster impact area, and orbital injection point.

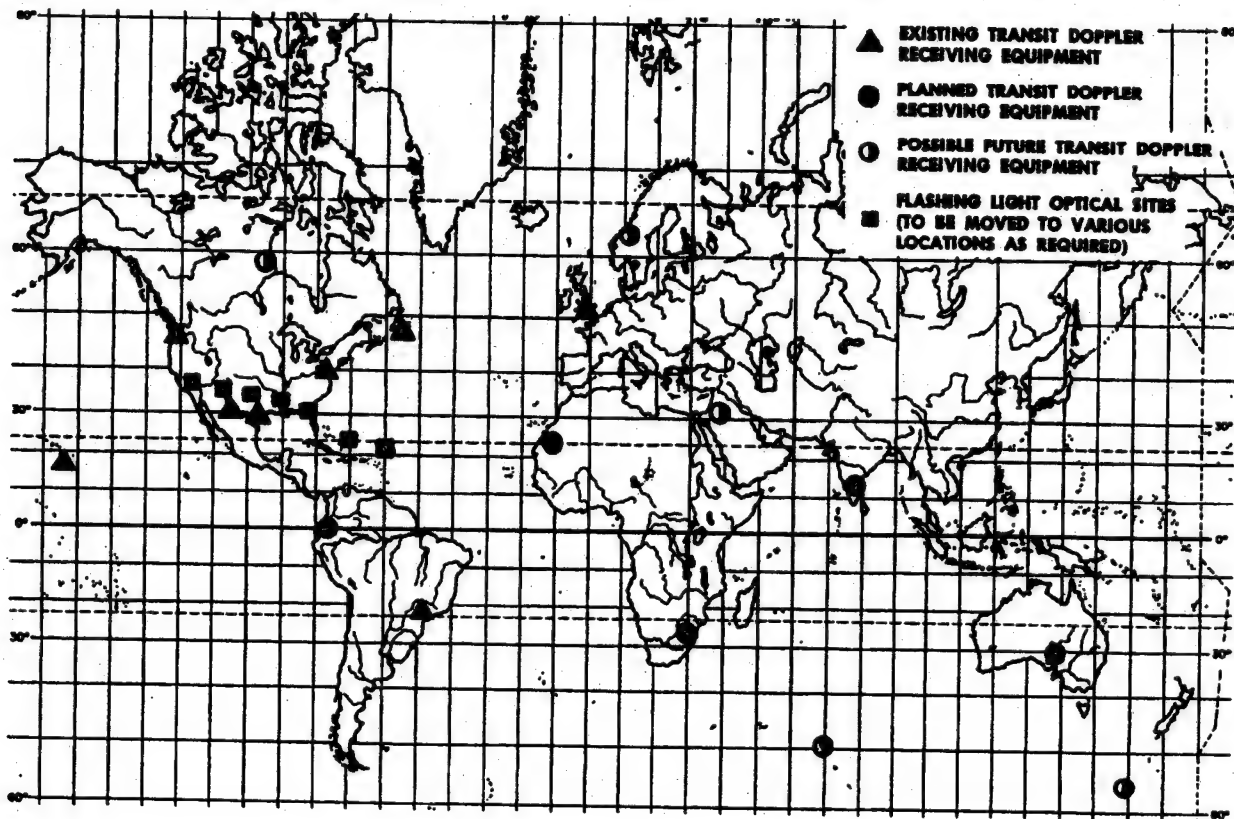


Figure 4. Location of ANNA tracking stations.

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Program Objectives

The Objectives of the ANNA Program are to:

1. Relate the major earth datums to each other and to the earth's center of mass.
2. Determine the structure of the earth's gravitational potential.

The vehicle will be launched from the Atlantic Missile Range in a northeasterly direction and will achieve a 600 nautical mile orbit with an inclination angle of 50°. Figure 3 shows the vehicle's trajectory.

Orbital Performance

Achievement of program objectives is dependent on tracking the satellite using the three measurement techniques: optical, radio doppler and radio ranging. Since a high degree of accuracy is required, the different types of observation will provide independent measurements for cross-checking. Two basic approaches to the application of the satellite for geodetic purposes will be utilized.

1. The *orbital method* requires extremely precise determination of the satellite orbit, including minor variations from the Keplerian Ellipse, and then uses this information as a "measuring rod" for connecting the various datums over which it passes.

2. The *inter-visible method* uses the satellite as a point of simultaneous observation from points on the earth. It does not require precise knowledge of the satellite ephemeris but it does require simultaneous sightings from several locations.

The expected accuracy in determination of the absolute geocentric variance of station positions is approximately 20 to 200 feet.

Ground Support and Tracking Stations

In regard to satellite tracking, each of the services is providing a system of tracking stations corresponding to its component in the satellite; i.e., the Air Force is providing for optical tracking, the Navy is providing for doppler ground support facilities, and the Army is providing ground facilities for the radio ranging.

MONTHLY PROGRESS—ANNA

● The DM-21 vehicle is scheduled for shipment to the Atlantic Missile Range during the third week of November and the Ablestar second stage is presently programmed for delivery during the fourth week of November. The prototype payload will be completed on 19 December. The flight payload is currently scheduled for shipment to the Atlantic Missile Range in early February 1962. (C)

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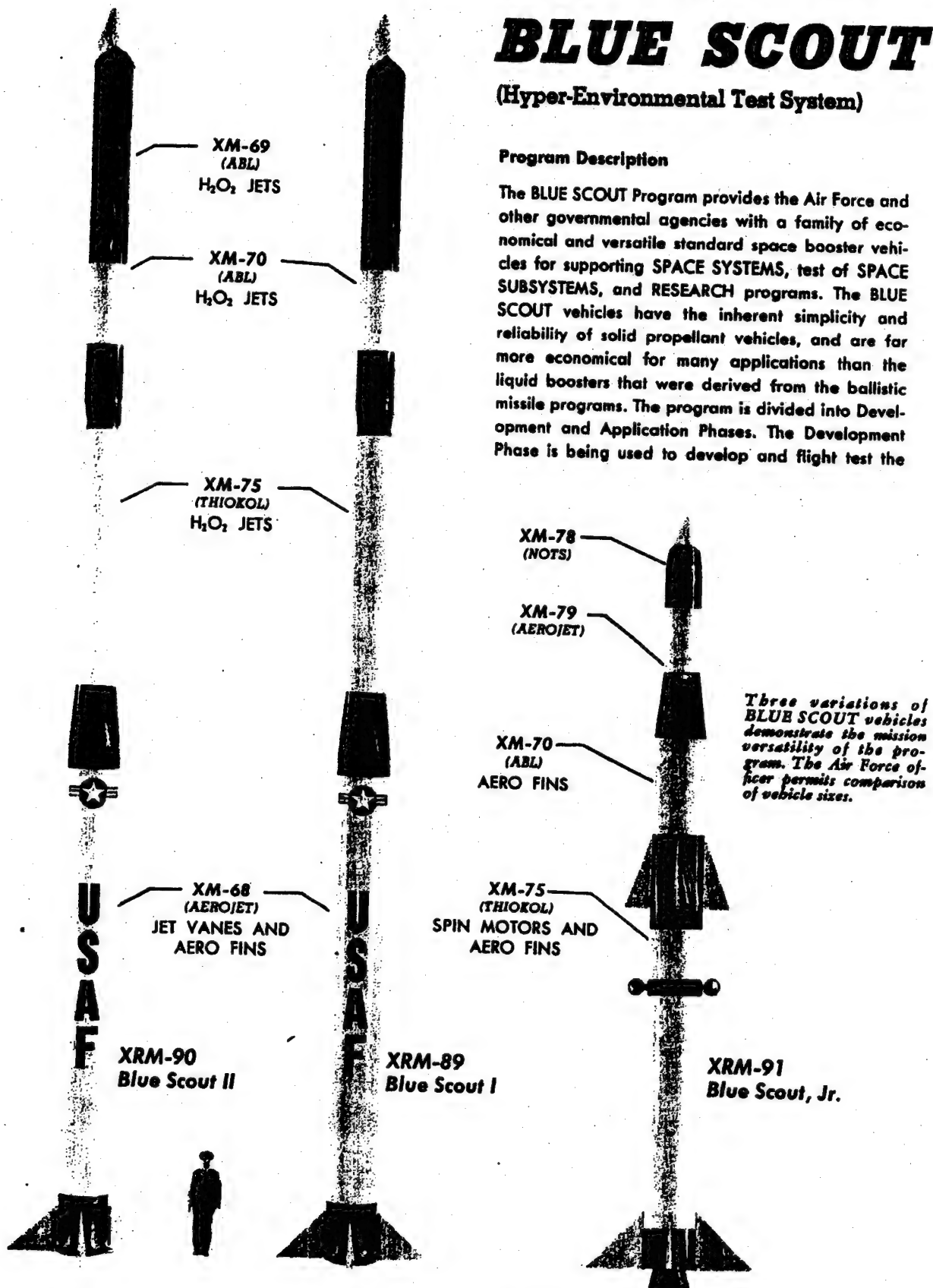
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BLUE SCOUT

(Hyper-Environmental Test System)

Program Description

The BLUE SCOUT Program provides the Air Force and other governmental agencies with a family of economical and versatile standard space booster vehicles for supporting SPACE SYSTEMS, test of SPACE SUBSYSTEMS, and RESEARCH programs. The BLUE SCOUT vehicles have the inherent simplicity and reliability of solid propellant vehicles, and are far more economical for many applications than the liquid boosters that were derived from the ballistic missile programs. The program is divided into Development and Application Phases. The Development Phase is being used to develop and flight test the



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solid propellant vehicles, to train AIR FORCE PERSONNEL in processing launch of the vehicles, and to accomplish BLUE SCOUT Program objectives. The Application Phase will support programs such as SAMOS, SAINT, BAMBI, ASSET, TRANSIT, and PROBES. The vehicle receipt, assembly, payload mating, checkout and launch will be accomplished by Air Force military personnel during the Application Phase.

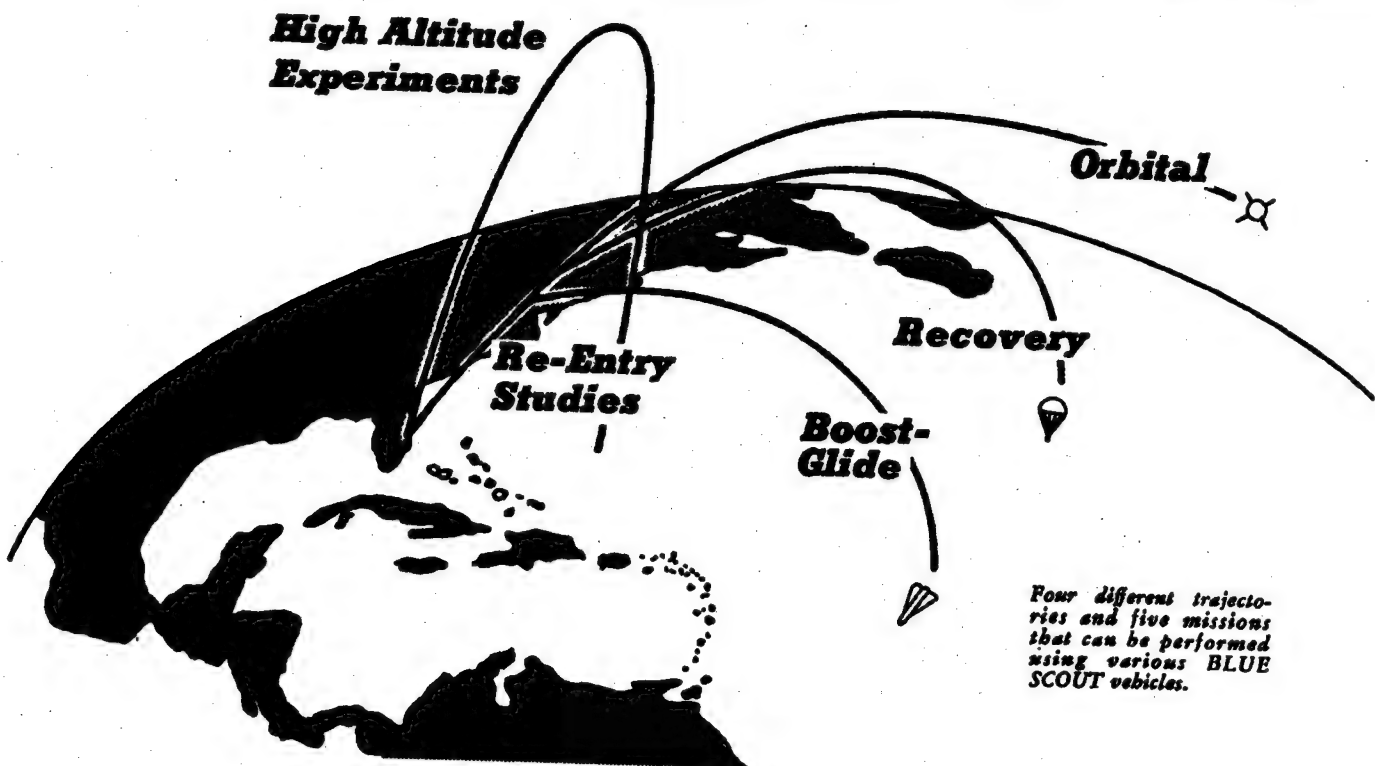
Performance

The BLUE SCOUT vehicles have a performance capability which permits them to: (1) place a 200-pound payload into a 400 nautical mile circular orbit, (2) boost a 200-pound payload to 4,000 nautical miles on a probe trajectory, (3) boost a 25-pound payload to 75,000 nautical miles on a probe trajectory, (4) place a 400-pound payload into a boost-glide trajectory at a velocity of 20,500 feet per second at 250,000 feet altitude. Besides ORBITAL FLIGHTS, PROBES, and BOOST-GLIDE trajectories, the vehicle can boost payloads into trajectories and downward booster HIGH-SPEED RE-ENTRY profiles, data RECOVERY capability and ATTITUDE STABILIZED final stage (and payload) are also provided.

Program Management

Development Phase: An abbreviated Development Plan, covering the Development Phase only, was approved on 9 January 1959. This plan gave Space Systems Division management responsibility. In June 1959, Aeronutronic Division of the Ford Motor Company was chosen through normal competitive bidding as the Payload, Test and Systems Integration Contractor. The procurement of vehicle components and associated support equipment, modified to meet BLUE SCOUT requirements, is being made through NASA, rather than direct procurement from the SCOUT contractors. Atlantic Missile Range launch complex 18 and an existing assembly building are being used for the Development Phase of the program. The 6555th Test Wing (Dev) manages the Development Test program at the Atlantic Missile Range and provides the Air Force personnel who are being trained to assume the vehicle processing, launch and evaluation tasks. An all-military operational capability will be developed from this group.

Application Phase: Space Systems Division will have the responsibility for providing BLUE SCOUT booster support to the Air Force and other government agencies for SPACE SYSTEMS, test of SPACE



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SUBSYSTEMS, and SPACE RESEARCH flight operations. This responsibility will include the coordination and establishment of agreements of responsibilities with payload agencies, both government and contractor, for the integration of the payloads and boosters; the monitoring of flight operation plans, objectives, schedules, accomplishment, and results; the funding action for the booster support; the planning for launch facilities and launch personnel; the procurement of booster vehicles and other equipment; and the over-all coordination required for execution of the BLUE SCOUT booster support program.

Missions

The Application Phase missions for the BLUE SCOUT Program, some of which are firm while others are in the planning stage, are as follows:

SAINT: Two BLUE SCOUT vehicles required, first launch from Atlantic Missile Range January, 1963.

ASSET: A requirement from Aeronautical Systems Division for seven BLUE SCOUT vehicles to be used in investigations of the aerodynamic and thermodynamic properties of boost-guide vehicles. The first launch is scheduled from Atlantic Missile Range in mid-1962 with a three-month launch interval.

BAMBI: Four BLUE SCOUT vehicles required, first launch from Pacific Missile Range in mid-1962, interval between launches of three months.

TRANSIT: Six BLUE SCOUT vehicles are required with the first launch occurring at Wallops Island early in 1962. The remaining launches will occur at the Pacific Missile Range from August through December 1962.

SOLAR RADIATION: Two BLUE SCOUT vehicles will be required in support of this Department of the Navy experiment. Launches will be from the Pacific Missile Range in April and June 1962.

PROBES PROGRAM: Fourteen BLUE SCOUT vehicles are required, one will be launched from the Pacific Missile Range in December 1962 and the remaining thirteen will be launched from the Atlantic Missile Range between January 1962 and March 1963.

NUCLEAR WEAPONS PHENOMONOLOGY: Three BLUE SCOUT vehicles are required for launch from the Atlantic Misile Range in mid-1962.

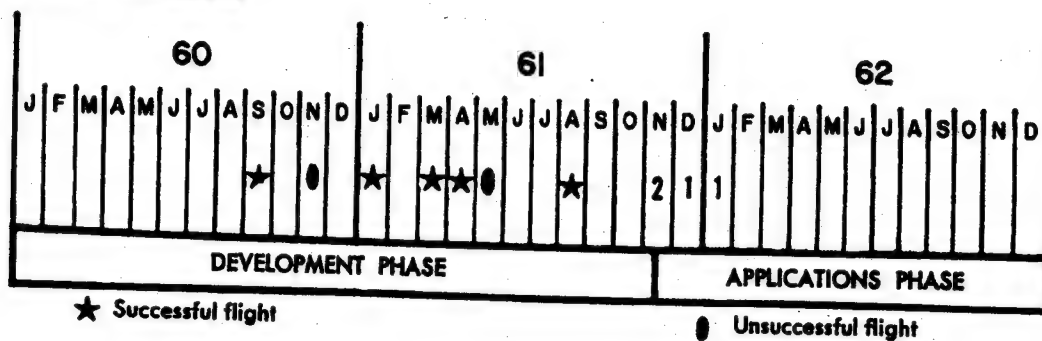
ION ENGINES: Two BLUE SCOUT vehicles are required for launch in mid-1962 at a currently undetermined range.

BEANSTALK: (Emergency Positive Communication Control System): The program manager, the Electronic Systems Division, selected Bendix Corporation as the prime system contractor. Twelve BLUE SCOUT vehicles (2-3-4 configuration) will be launched during CY62 from the Pacific Missile Range.

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Launch Schedule



Flight History

Blue Scout	Launch Date	Type of Flight*	Type Designation	Remarks
D1	21 September	A	XRM-91	Telemetry was lost prior to fourth stage burnout. All of the primary (vehicle) objectives were accomplished; none of the secondary (payload) objectives were achieved.
D2	8 November	A	XRM-91	A second stage motor failure occurred at T plus 60 seconds. The vehicle impacted approximately 240 n.m. downrange.
D3	7 January	A&C	XRM-89	The 392-pound payload was launched successfully. The recovery capsule survived re-entry but was not recovered. All other primary objectives were achieved as were the majority of secondary objectives.
D4	3 March	A	XRM-90	The 172-pound payload was launched successfully. The test was completely successful. All primary and secondary objectives were achieved. Valuable payload experiment data were obtained.
D5	12 April	A&C	XRM-90	The 365-pound payload was launched on a probe trajectory. Seven of the eleven primary test objectives were accomplished and one was partially achieved.
D6	9 May	A&C	XRM-89	Indications are that a control motor power lead became disconnected during second stage burning and caused the vehicle to veer left from the programmed trajectory. At T plus 81 seconds range safety action was taken.
O1	17 August	A	XRM-91	Telemetry failed after approximately 16 seconds of fourth stage burning. The missile functioned normally during the operation life of telemetry.

***Type of Flight**

A — High Altitude Experiments
B — Re-Entry Study

C — Recovery
D — Orbital

E — Boost-Glide

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MONTHLY PROGRESS—BLUE SCOUT

Program Administration

● Space Systems Division representatives attended a Project BEANSTALK Program Requirements Document review at Vandenberg Air Force Base on 5 October. The Program Requirements Document has been approved by Hq Space Systems Division and the 6595th Aerospace Test Wing and will be distributed early in November. (U)

● Representatives from Vought Astronautics; Space, Electronics, and Aeronautical Systems Divisions; Air Force Special Weapons Center, 6595th Aerospace Test Wing; and the Pacific Missile Range attended the Project BEANSTALK status review meeting at Bendix Systems Division, Michigan facilities on 10, 11, and 12 October. A configuration review discussion resulted in clarifying and framing vehicle configuration decisions. Project problem areas were reviewed in detail and in each area specific requirements for action by the responsible agencies were established. In addition, Project BEANSTALK requirements and objectives were further defined. (U)

● Space Systems Division representatives attended a meeting at Sheppard Air Force Base, Texas, on 10, 11, and 12 October and assisted in establishing the BLUE SCOUT training program to be used to train 6595th Aerospace Test Wing and 6555th Aerospace Test Wing military personnel. (U)



Figure 1. Installing thermocouples (right) on the BLUE SCOUT D-8 payload inside the vacuum chamber. Test equipment outside the vacuum chamber during payload "hot-cold" tests.





Figure 2. Air Force technicians, left, during checkout of the BLUE SCOUT D-8 vehicle... View inside Atlantic Missile Range Launch Complex 18 blockhouse prior to the 1 November launch. It is interesting to note the simplicity of the BLUE SCOUT launch control panel when compared to the panels required for boosters using liquid propellants... Launch (opposite page) of BLUE SCOUT D-8 on 1 November.





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● A Space Systems Division representative attended a meeting at Kirtland Air Force Base, New Mexico, on 24 October. He assisted Air Force Special Weapons Center personnel in planning space probe operations for certain AFSWC payloads. (U)

● A Delivery Order has been sent to NASA for vehicles to support the Satellite Inspector, ION ENGINE, and AFOAR Probes Programs. Deliveries will begin in February 1962. (U)

● A letter contract has been awarded Chance Vaught Corporation to conduct a boost-glide study to determine the booster-payload configuration for the Aeronautical Systems Division ASSET Program. (U)

Flight Test Progress

● Early in October the NASA requested that the Space Systems Division expedite completion of the NASA-required D-8 vehicle modifications, so that a launch during the week of 30 October could be achieved. Personnel of the 6555th Aerospace Test Wing and the Aeronutronic Division worked on an overtime basis and completed the modifications so that the guided, four stage XRM-92 vehicle was ready for launch on 27 October. The launch was initially scheduled for 1030 EST on 31 October. The launch was delayed by a payload umbilical malfunction and subsequently cancelled at 1230 EST because of a telemetry power failure. The launch was rescheduled for 1 November. (U)

● The eighth BLUE SCOUT vehicle (D-8) was launched from Atlantic Missile Range Launch Complex 18 at 1032 EST on 1 November. Ignition occurred and liftoff was normal. The missile's flight became erratic and at approximately T+30 seconds it was destroyed. The cause of the malfunction is being actively investigated, but has not been determined at this time. This launch was the last in the development phase of the BLUE SCOUT family of missiles. (U)

● The launch of the ninth BLUE SCOUT vehicle (D-7) is scheduled during January 1962. The BLUE SCOUT I (XRM-89) vehicle will boost an ERD-2 re-entry vehicle from the Atlantic Missile Range on a hypersonic re-entry trajectory. The re-entry vehicle is designed to withstand a velocity of from 16,500 to 18,000 feet per second at altitudes between 418,000 and 125,000 feet. It contains five transmitters (one S-Band, one C-Band, one X-Band and two L-Band) mounted inside a nonablative sphere-cylinder-cone heat shield. Flight objectives are:

1. To obtain BLUE SCOUT I performance data.
 2. To measure the effect of re-entry ionization on radio frequency.
 3. To return the five transmitters contained in the partial re-entry vehicle into the atmosphere at a hypersonic velocity.
 4. To receive transmitted signals on the ground with reflected signals monitored in the vehicle for all ERD-2 frequencies.
 5. To provide data on absorption and reflection of RF signals as a function of frequency.
 6. To gather vehicle instrumentation data by means of X-Band pulse duration telemetry. (U)
- The launches of BLUE SCOUT Junior vehicles 0-2 and 0-3 from the NERV pad at Point Arguello are scheduled for late November and early December, respectively. These vehicles were originally scheduled for launch in mid-October but delays in deliver-

ing the Air Force Special Weapons Center payloads caused the postponement. (U)

Facilities

- BLUE SCOUT launch facilities under construction at Point Arguello by the U.S. Navy Bureau of Yards and Docks for NASA are scheduled for completion in March 1962. Operational control will then be assigned to the Air Force Systems Command. (U)
- Authority to complete the design of the BLUE SCOUT Atlantic Missile Range facilities was received on 18 October. The facilities planned are a rocket motor storage building, an assembly building, a systems checkout building and a launch complex modification. These facilities will be adequate to support thirteen launches per year. Schedules for completion of the design and construction are being prepared to meet program requirements. (U)

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DYNA SOAR

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Program History—Competition for the DYNA SOAR study contract was initiated in 1958 and resulted in the Boeing Airplane Company and the Martin Company being awarded the follow-on contract to more fully define their proposed approaches. In November 1959, following review and evaluation of the Boeing/Martin detailed studies by a Source Selection Board, it was announced that Boeing had been selected as the glider and system integration prime contractor, with Martin furnishing modified TITAN ICBM's for booster support. The conceptual phase of DYNA SOAR concluded with a study program requirement known as Phase Alpha. The objective of this study was to reaffirm proposed glider design. In April 1960, Phase Alpha was completed and results were presented to the Department of Defense. On 9 May, formal approval of the DYNA SOAR Step I Program was received by AFBMD/BMC from WADD/ASC.

During the period covering program go-ahead to the end of CY 1960, efforts on the program were concentrated on design refinements to TITAN I and possible increased booster performance to accomplish program objectives. Studies on booster capabilities revealed many favorable factors on cost, time and expanded objectives by use of the XSM-68B (TITAN II) as the booster. Results of these studies were presented to Headquarters USAF and the Department of Defense. Headquarters USAF directed

use of TITAN II as the SYSTEM 620 DYNA SOAR Step I Booster. Formal direction to use TITAN II was received by AFBMD/BMC from WADD/ASC on 13 January 1961. Effective April 1961, the symbols for AFBMD/BMC and WADD were redesignated SSD and ASD, respectively.

Program Objectives—The DYNA SOAR Program will explore the possibilities of manned flight in the hypersonic and orbital realms. The program will proceed in three major steps from a research and test phase to an operational military system. In Step I, a full scale, minimum sized manned glider will be developed. A modified version of the TITAN II ICBM will boost the glider into hypersonic flight at velocities up to 22,000 ft/sec and permit conventional landing at a predetermined site. In Step II the glider will be tested, using a more powerful booster to achieve orbital velocities. This phase may be expanded into an interim operational weapon system providing all-weather reconnaissance and satellite interceptor capabilities. The objectives of Step II are to test vehicle performance between 22,000 ft/sec and orbital velocities; and to gather re-entry data from various orbits; and to test military equipment and man-machine relationships. Step III will provide an operational weapon system with a vehicle that will operate primarily in a hypersonic glide, be able to maneuver within the atmosphere, and be able to make a conventional landing at a predetermined

FIRST — SECOND STAGE SEPARATION

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site. The capability of DYNA SOAR type systems to perform these programmed missions appears attractive as a result of studies made to date. The missions under study are: reconnaissance (manned and unmanned); air and space defense; strategic bombardment and logistics support. Manned and unmanned versions are being considered where applicable.

Flight Program — Step I includes twenty air-launched, manned flights with the glider being dropped from a B-52. Sixteen booster-launched flights will follow; flights 1 and 2 are designated as unmanned flights. If all significant flight objectives are achieved, the third flight will be manned. Flights 3 and 4 have been programmed as backup flights in the event that flights 1 and/or 2 do not achieve program objectives. The frequency is five launches at two-month intervals and eleven launches at six-week intervals. The range from Wendover AFB, Utah, to Edwards AFB is adequately instrumented for the tracking and telemetry required during the air-launched tests of the DYNA SOAR glider. Instrumentation sites for the AMR launches will be located at Cape Canaveral, San Salvador, Mayaguana, Antigua, Santa Lucia, and Fortaleza. Instrumentation, tracking, and recovery ships will be provided to supply additional support for the AMR launches. Landing facilities will be provided at Fortaleza, Brazil; Santa Lucia, Lesser Antilles; and Mayaguana, Bahama Islands.

Program Responsibilities — Steps I and II of the DYNA SOAR Program are to be conducted by the USAF with NASA participation. USAF will provide program management and technical direction, with ASD having responsibility for over-all system management.

SSD is responsible for the booster, and its Aerospace Ground Equipment (AGE), special airborne systems, and booster requirements of the launch complex. ASD will have responsibility for glider, glider AGE, and subsystem development. NASA will provide technical support in the design and operation of the glider in obtaining basic aeronautical and space design information.

Technical Approach — Space Systems Division technical approach to meet the objectives of the program are:

1. Modifying a TITAN II ICBM by adding stabilizing fins; strengthening the holddown and skirt area, intertank and interstage sections; redesigning the guidance bay; incorporating a malfunction detection system.
2. Modifying the XLR 87-AJ-5 and XLR 91-AJ-5 rocket engines to obtain structural compatibility with the modified booster; include malfunction detection system shutdown and fail safe systems.
3. Modification of an AMR launch pad.
4. Provide an integrated launch countdown.

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MONTHLY PROGRESS—DYNA SOAR

Program Administration

● The Space Systems Division has participated in several briefings to Hq Air Force Systems Command and Hq USAF on possible acceleration to the DYNA SOAR Program. (U)

Technical Progress

● Aerojet-General delivered one first and one second stage DYNA SOAR Step I engine (designated "E" engines) to the Martin Company Baltimore facilities during the week of 23 October. These "E" engines will be used for Auxiliary System Functional

Test Stand (ASFTS) testing and have the following characteristics:

1. They are nonfireable rocket engines similar in configuration to the TITAN II engines as modified for DYNA SOAR.

2. They simulate the mass, moment of inertia and response characteristics of the actual DYNA SOAR engines.

● During the course of ASFTS testing, engine installation will be demonstrated, leakage and electrical checks will be performed, and functional compatibility with ground support and test equipment will be checked. (U)

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MERCURY

Project MERCURY represents the transitional threshold between this nation's cumulative achievements in space research and the beginning of actual space travel by man. The primary program objective is to place a manned satellite into orbit about the earth, and to effect a controlled re-entry and successful recovery of the man and capsule. Unmanned ballistic trajectory and unmanned orbital flights will be used to verify the effectiveness and reliability of an extensive research program prior to manned orbital flights. The program will be conducted over a period of approximately four years. The initial R & D flight test was accomplished successfully in September 1959. The total program accomplishment is under the direction of NASA. The primary responsibility of Space Systems Division to date consists of: (a) providing 15 ATLAS boosters modified in accordance with program objectives and pilot safety factors, and (b) determination of trajectories and the launching and control of vehicles through injection into orbit.

Major contractors participating in the Space Systems Division portion of this program include: Aerospace Corporation, systems engineering and technical direction; Convair-Astronautics, modified ATLAS boosters; GE/Burroughs, ATLAS guidance equipment; and Rocketdyne, engines. All of these companies also participate in launch operations, special studies and engineering efforts peculiar to Project MERCURY requirements.

The MERCURY astronomical symbol (♄) with the "R" for Reliability will be attached to those components and missile end items which have been selected and accepted for use in boosters identified for Project MERCURY.

CAPSULE

ATLAS



Flight Parameters

Apogee, nautical miles	137 (approx)
Perigee, nautical miles	87 (approx)
Number of Orbits	3
Inclination Angle	33°

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General Sequence of Events for MA-5 Flight (Orbital)

Following the initial hold-down, the vehicle containing a primate will lift-off Atlantic Missile Range Stand 14. Upon a General Electric ground guidance command the booster engine will shut down and staging will occur. Twenty seconds after booster staging, the pylon ring separation explosive bolts fire, the pylon clamp ring is separated, and the escape rocket is fired separating the pylon from the capsule. The sustainer engine accelerates the capsule to the predetermined velocity. The sustainer and vernier engines will shut down upon ground guidance command and the capsule separation explosive bolts will fire. The posigrade rockets will fire and separate capsule from the booster. After five seconds of damping the capsule initiates a 180° yaw maneuver and pitches to a 34° blunt-end-forward attitude. The capsule will maintain a 34° attitude throughout its three orbits. At a specified time the Automatic Stabilization and Control System is commanded from the ground to start the orientation mode. If the capsule is in the proper attitude the retro-rockets fire. Sixty seconds after retro-fire the retro and posigrade package will be jettisoned and the capsule will assume a re-entry attitude. When the capsule has descended to 21,000 feet, the drogue parachute is deployed. At 10,000 feet, the drogue parachute and antenna fairing will be jettisoned and the main parachute deployed. At impact the parachute is jettisoned and the recovery aids are deployed.

CON

Space System

MERCURY Supply

- Fifteen modified AT
- Launch complex and
- Systems developmen
- Studies and technica
- Safety program

Trajectory Outli

Space Systems Division Launch Responsibility

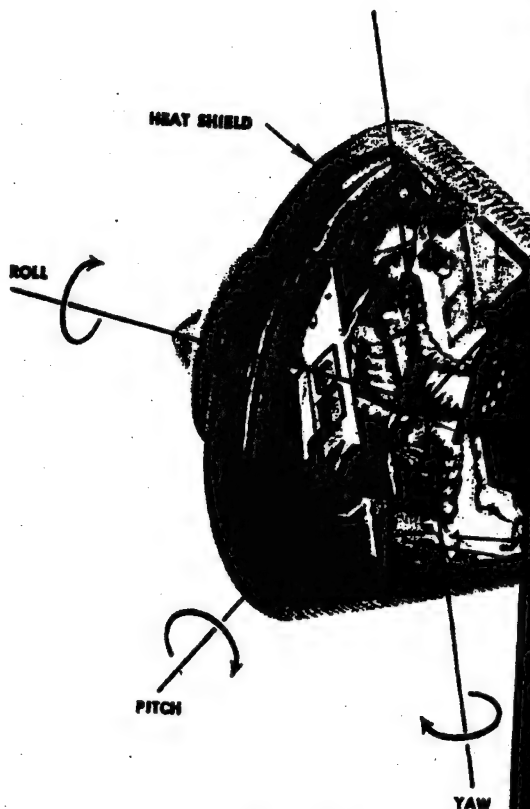
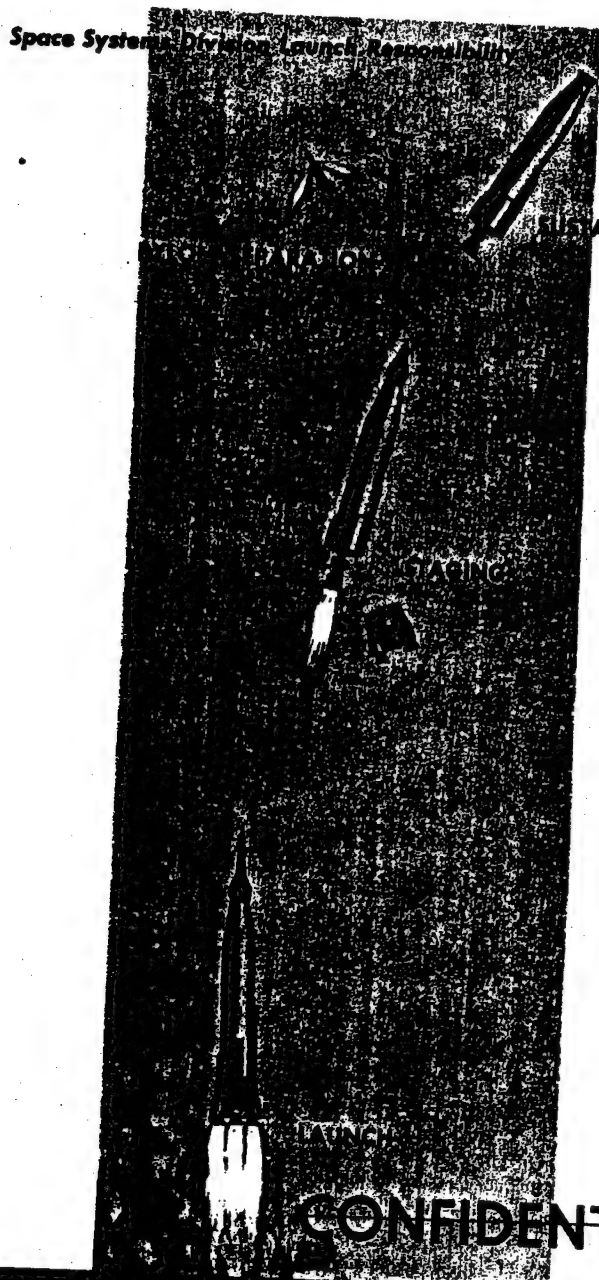
CAPSULE SEPARATION

ROTATION

OR

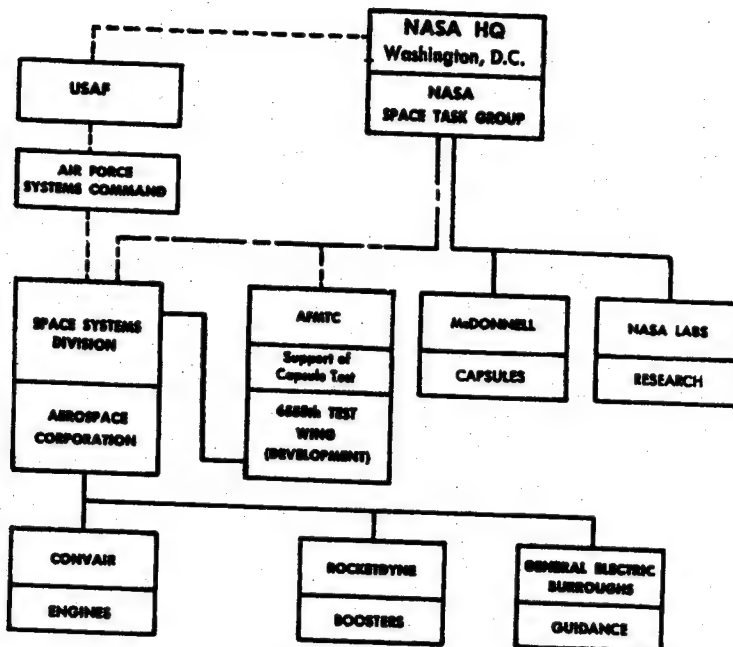
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Division
 Functions
 S "D" boosters
 support thru orbital insertion
 assistance



for MA-5 Flight

T ATTITUDE

137 n.m.

87 n.m.

RETRO ROCKETS FIRE

RE-ENTRY

RETRO and POSIGRADE
 ROCKETS JETTISONED

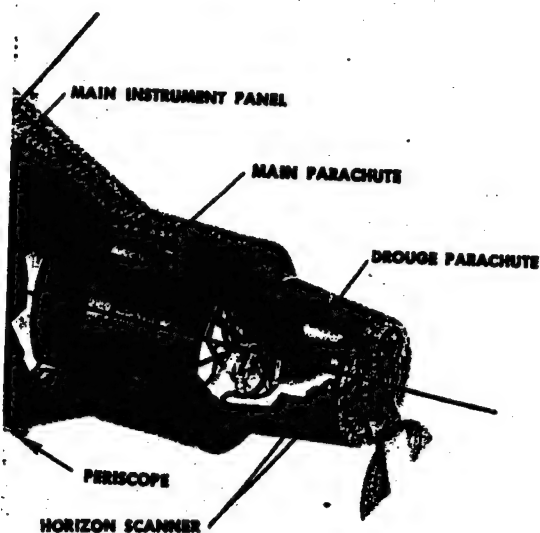
— Program Management
 and Technical Direction
 - - - Program Management
 - - - - - Program Changes

NORMAL ORBITAL FLIGHT

DROGUE PARACHUTE OPENS

MAIN PARACHUTE DEPLOYED

IMPACT



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L-3

Launch Schedule

	J	1
★	A	9
	S	5
	O	9
	N	
	D	
0	J	1
	A	9
	S	6
	O	0
	N	
	D	
★	J	
	F	
	M	
0	A	1
	M	9
	J	6
	J	1
★	A	
	S	
	O	
1	N	
1	D	
	J	
1	F	
1	M	
1	A	
	M	1
1	J	9
	J	6
	A	2
	S	
1	O	
	N	
	D	
	J	
	F	
1	M	
	A	
	M	1
	J	9
1	J	6
	A	3
	S	
1	O	
	N	
	D	

Flight History

MERCURY Flight	Launch Date	ATLAS No.	Remarks
Big Joe I	9 September	10D	Flight test objectives were achieved to such a high degree that a second, similar flight was cancelled. The capsule was recovered intact.
MA-1	29 July	50D	After one minute of normal flight guidance, rate, track lock, and telemetry were lost and the vehicle was destroyed. The exact cause of the malfunction has not been determined.
MA-2	21 February	67D	Test analyses have been completed and all booster and capsule test objectives were achieved.
MA-3	25 April	100D	Vehicle destroyed after 43 seconds of flight by the Range Safety Officer. Programmed pitch and roll functions failed to occur and Range Safety criteria were violated. Investigations to determine the cause of programmer failure have resulted in changes to the autopilot system of the MA-4 and subsequent boosters.
MA-4	13 September	88D	Test analyses have been completed and the entire test has been considered highly successful.

- ★ Successful flight
- 0 Unsuccessful flight

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MONTHLY PROGRESS—MERCURY

Flight Test Progress

MA-4 Flight Evaluation

● The flight test evaluation for MA-4, launched on 13 September, indicates that the performance of the ATLAS launch vehicle was satisfactory and that all ATLAS flight objectives were accomplished. The MERCURY capsule was placed into the desired orbit by ATLAS 88D and, as planned, successfully completed one orbit of the earth. From lift-off to landing, the capsule was in flight approximately one hour and forty-eight minutes. The capsule landed 67.0 nautical miles west and 11.6 nautical miles north of the planned impact point of 32.04° North latitude and 60.62° West longitude (approximately 200 nautical miles east of Bermuda). ATLAS 88D was itself injected into orbit. Information received from the Air Force Space Detection and Tracking System (SPADATS)

stated that track was lost after the third orbit and that impact probably occurred in the Pacific, south-east of the Hawaiian Islands. (C)

MA-5 Prelaunch

● The launch of MA-5 is scheduled to occur at Atlantic Missile Range Complex 14 in late November. ATLAS 93D, the MA-5 booster, was delivered to the Atlantic Missile Range on 9 October following the successful completion of the Factory Roll-out Inspection. It was erected on stand 14 on 13 October. The autopilot programmer, modified to eliminate the 10.5 cycle per second oscillation encountered on MA-4, was installed in ATLAS 93D and the Booster Flight Acceptance Composite Test was accomplished on 31 October. This flight requires that NASA Capsule No. 9, containing a primate, orbit the earth three times and impact in the Atlantic Ocean approximately 688 miles downrange from Cape Canaveral. (C)

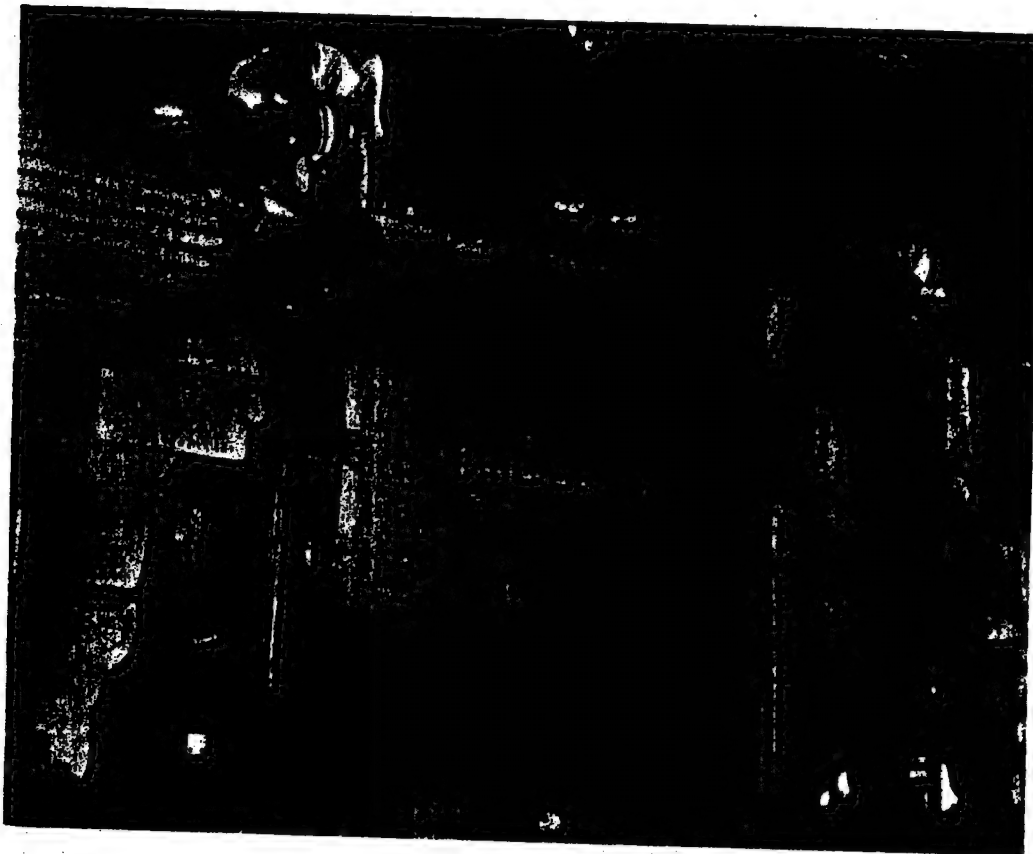


Figure 1. Installing booster engine fairing on ATLAS 93D, the MA-5 booster in Atlantic Missile Range Hangar J.

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Technical Progress

● The ATLAS Launch Vehicle Manned Flight Surveillance Board, established by the Space Systems Division for the specific purpose of providing continuing scrutiny of MERCURY/ATLAS launch vehicle configuration, convened at the Space Systems Division on 23 October. This meeting was held to ensure that all action items resulting from previous flight anomalies had received, or were in the process of receiving, proper attention. An item of concern at this meeting was the fluctuation in rate data (noise) during the MA-4 flight. The levels were in excess of those anticipated for the flight. A review of radar data subsequent to the 88D flight showed that fluctuation, or noise, deviated from the nominal band limits at the lower elevation angle toward the end of powered flight. Flight test data from the RANGER I flight showed a similar trend. A major effort was initiated to determine the source of the noise, the effect on the MERCURY Program, and the corrective measures which must be taken. (C)

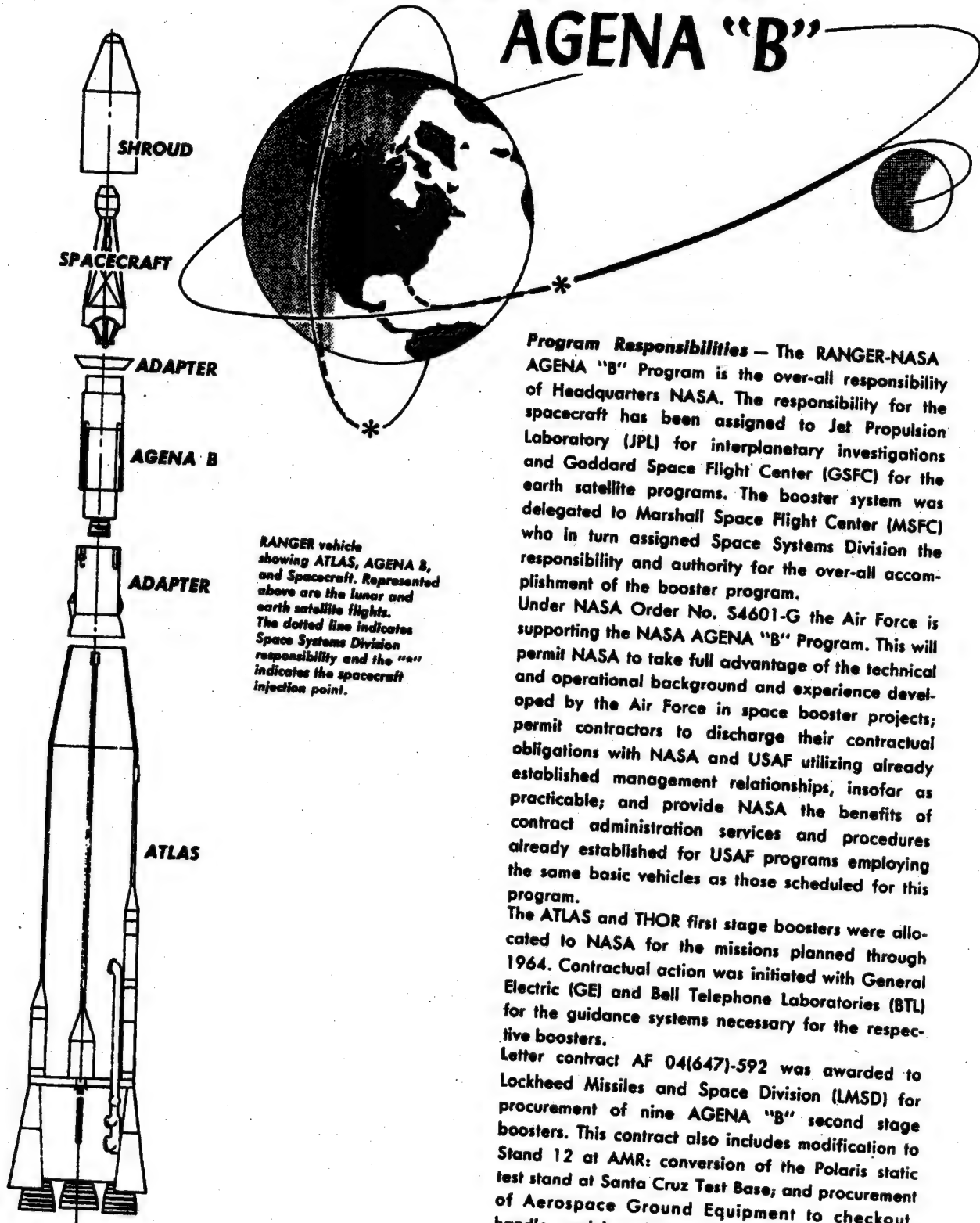
Figure 2. Erecting the MERCURY/ATLAS booster on Atlantic Missile Range Stand 14 on 13 October. The launch of a primate into orbit is scheduled for late November.



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RANGER-NASA AGENA "B"



RANGER vehicle showing ATLAS, AGENA B, and Spacecraft. Represented above are the lunar and earth satellite flights. The dotted line indicates Space Systems Division responsibility and the "x" indicates the spacecraft injection point.

Program Responsibilities — The RANGER-NASA AGENA "B" Program is the over-all responsibility of Headquarters NASA. The responsibility for the spacecraft has been assigned to Jet Propulsion Laboratory (JPL) for interplanetary investigations and Goddard Space Flight Center (GSFC) for the earth satellite programs. The booster system was delegated to Marshall Space Flight Center (MSFC) who in turn assigned Space Systems Division the responsibility and authority for the over-all accomplishment of the booster program.

Under NASA Order No. S4601-G the Air Force is supporting the NASA AGENA "B" Program. This will permit NASA to take full advantage of the technical and operational background and experience developed by the Air Force in space booster projects; permit contractors to discharge their contractual obligations with NASA and USAF utilizing already established management relationships, insofar as practicable; and provide NASA the benefits of contract administration services and procedures already established for USAF programs employing the same basic vehicles as those scheduled for this program.

The ATLAS and THOR first stage boosters were allocated to NASA for the missions planned through 1964. Contractual action was initiated with General Electric (GE) and Bell Telephone Laboratories (BTL) for the guidance systems necessary for the respective boosters.

Letter contract AF 04(647)-592 was awarded to Lockheed Missiles and Space Division (LMSD) for procurement of nine AGENA "B" second stage boosters. This contract also includes modification to Stand 12 at AMR; conversion of the Polaris static test stand at Santa Cruz Test Base; and procurement of Aerospace Ground Equipment to checkout, handle, and launch the AGENA "B" booster.

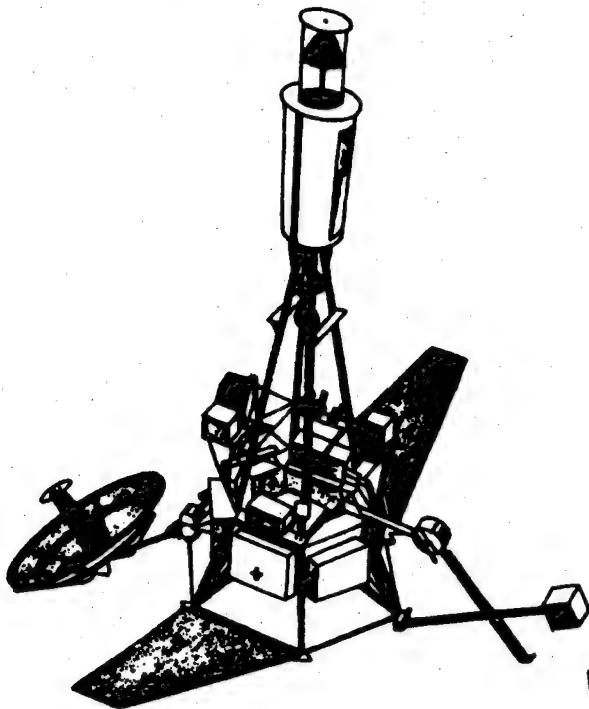
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RANGER Program



The ATLAS/AGENA "B" booster system will include the standard ATLAS "D" first stage booster with GE Mod III G guidance system. The second stage will be a modified AGENA B second stage booster similar to those used in several Air Force space programs. The only major change to be incorporated for these missions is the capability to separate the RANGER spacecraft and fire a retro rocket to prevent the AGENA "B" from hitting the moon. Lunar impact of the AGENA "B" is not desired due to its unsterile condition.

The RANGER Program will be the initial launch by NASA of the Air Force developed AGENA "B" second stage. Maximum effort is being given toward using the same components that have been flown on Air Force missions.

Scientific Satellite Program

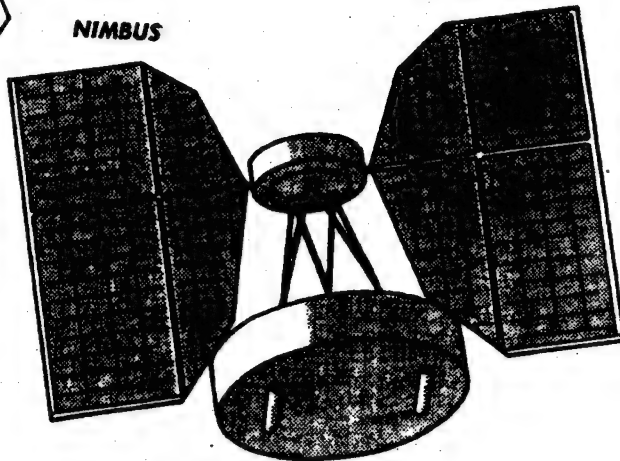
Lunar Test Missions

The RANGER Program is a series of five deep space probes to be launched from the Atlantic Missile Range (AMR) on the ATLAS/AGENA B booster system. Jet Propulsion Laboratory (JPL) under contract from the National Aeronautics and Space Administration (NASA) is responsible for the missions and providing the spacecraft hardware. The mission of the first two RANGER launches will be an interplanetary investigation in support of the follow-on lunar impact mission. The orbit will be highly elliptical (near escape velocity) and have an apogee of approximately 625,000 nautical miles. The spacecraft is planned for one orbit with approximately a 50 day period.

Lunar Impact Missions

The remaining three launches will impact the surface of the moon and transmit scientific information back to the earth. Experiments are designed to measure seismographic disturbances, temperature changes and impact acceleration. These Ranger spacecrafts will also have the capability of accomplishing a mid-course maneuver to correct for minor errors in the trajectory.

NIMBUS



NIMBUS is a 650 pound earth oriented stabilized satellite to be placed in a "high noon" circular orbit at 600 miles altitude. This satellite is intended to serve as a platform for experiments designed to explore the meteorological process of the earth's atmosphere. Experiments include full picture coverage of the clouds over the entire earth, electromagnetic radiation maps of the earth, and the atmosphere around the earth and other experiments to determine the effect of the sun on the atmosphere.

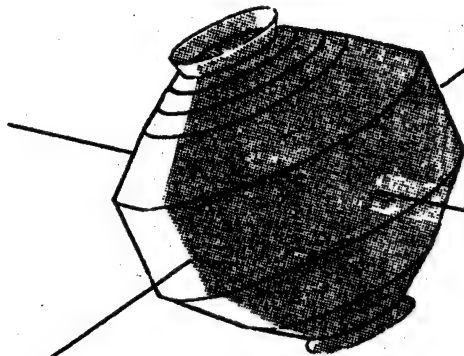
A total of five NIMBUS satellites will be put into orbit by the THOR/AGENA B booster from Vandenberg Air Force Base. The first launch is scheduled for June 1962 with subsequent launches every six months. The booster system will be the same as used on Topside Sounder and the Communication Satellite with slight modification to accept the larger payload.

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TOPSIDE SOUNDER SATELLITE MISSION (S-27)



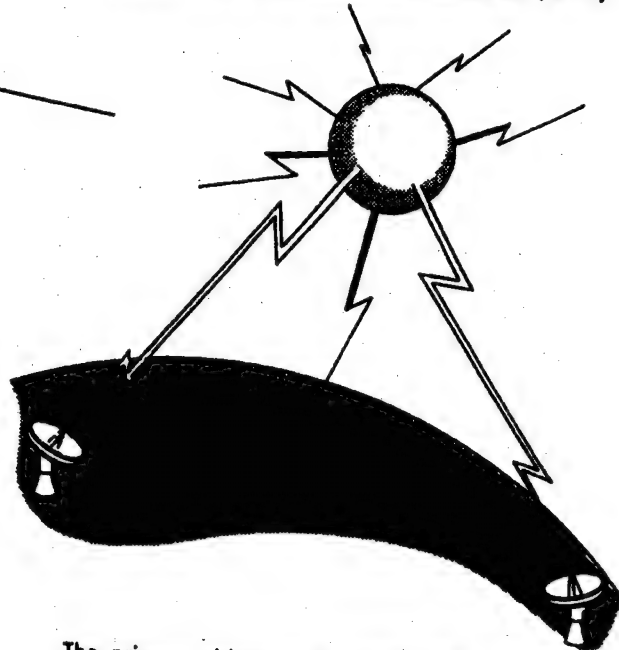
The primary objective of the S-27 Satellite is the examination of the structure of the ionosphere from above in a manner similar to that now being done by ground-based ionospheric sounders. In particular the objective is to obtain information about the ionosphere in the region above the F layer maximum. Other objectives are to measure the cosmic noise level and determine the plasma frequency at the altitude of the satellite.

The Topside Sounder (S-27) will be launched on board a THOR/AGENA "B" booster system from Vandenberg Air Force Base into a 540 n.m. circular orbit. This will be the first Pacific Missile Range launch in this program; however, it will be similar to previous Air Force THOR/AGENA B launches from Vandenberg Air Force Base.

The THOR/AGENA "B" booster system will be composed of the standard DM-21 THOR booster with Bell Telephone Laboratory guidance systems and AGENA "B" second stage similar to the one used

in the RANGER launches from Atlantic Missile Range. Minor modifications will be made to the AGENA to make it compatible to the mission; however, maximum use will be made of the experience developed in the RANGER Program.

COMMUNICATION SATELLITE MISSION (A-12)



The primary objective of Project Echo A-12 is the demonstration of a spacecraft deployment and rigidization technique applicable to passive communications satellites. Development of the spacecraft will be undertaken by the Langley Research Center. The Communication Satellite (A-12) will be launched into a 650 n.m. orbit aboard the THOR/AGENA "B" booster. The shroud which surrounds and protects the Communication Satellite will be the same general shape as the S-27 except the length is reduced to accommodate the shorter space craft.

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● **Unsuccessful flight**

LEGEND

A	RANGER	ATLAS	AMR	G	EGO	ATLAS	AMR
B	Topside Sounder (5-27)	THOR	AMR	H	BACKUP (EGO)	ATLAS	AMR
C	ECHO (A-12)	THOR	PMR	I	REBOUND	ATLAS	PMR
D	BACKUP (5-27 or A-12)	THOR	PMR	J	CALORIE	ATLAS	AMR
E	MARINER	ATLAS	AMR	K	OAD	ATLAS	AMR
F	NIMBUS	THOR	PMR				

Flight	First Stage Booster	AGENA No.	Launch Date	Remarks
RA-1	111D	6001	23 August	<i>ATLAS performance and AGENA performance during first burn was nominal. Ignition of the AGENA engine for the second burn was not obtained. Commands were transmitted to the spacecraft and telemetry from the spacecraft confirmed that all experiments were functioning.</i>

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MONTHLY PROGRESS — RANGER

● The second Lunar Probe vehicle (RA-2) was not launched during the 20 through 27 October launch period. The countdown on 20 October was terminated at T-40 minutes because of a problem which developed in the ATLAS guidance system circuitry. A 72-hour rescheduling period was required to correct this problem and de-mate the spacecraft in order to permit degraded spacecraft experiments to be corrected. During the launch attempt on 23 October, the countdown was terminated at T-47 minutes when a hydraulic leak developed in one ATLAS vernier engine (V-2). The launch was rescheduled for 25 October to allow time to replace this engine. However, AGENA B hydraulic system discrepancies encountered during the DISCOVERER XXXIII flight and during the hot firing of the RA-3 AGENA vehicle at Santa Cruz Test Base, caused the launch to be cancelled for this period. An investigation is being conducted to determine the cause of the hydraulic system malfunction. The RA-2 launch is currently scheduled for the period of 18 through 26 November. (C)

● Among the objectives of the RA-2 flight are:

1. Inject the RANGER Spacecraft into orbit with an apogee of 658,000 n.m. and a perigee of 27,000 n.m. using the ATLAS D/AGENA B vehicle.

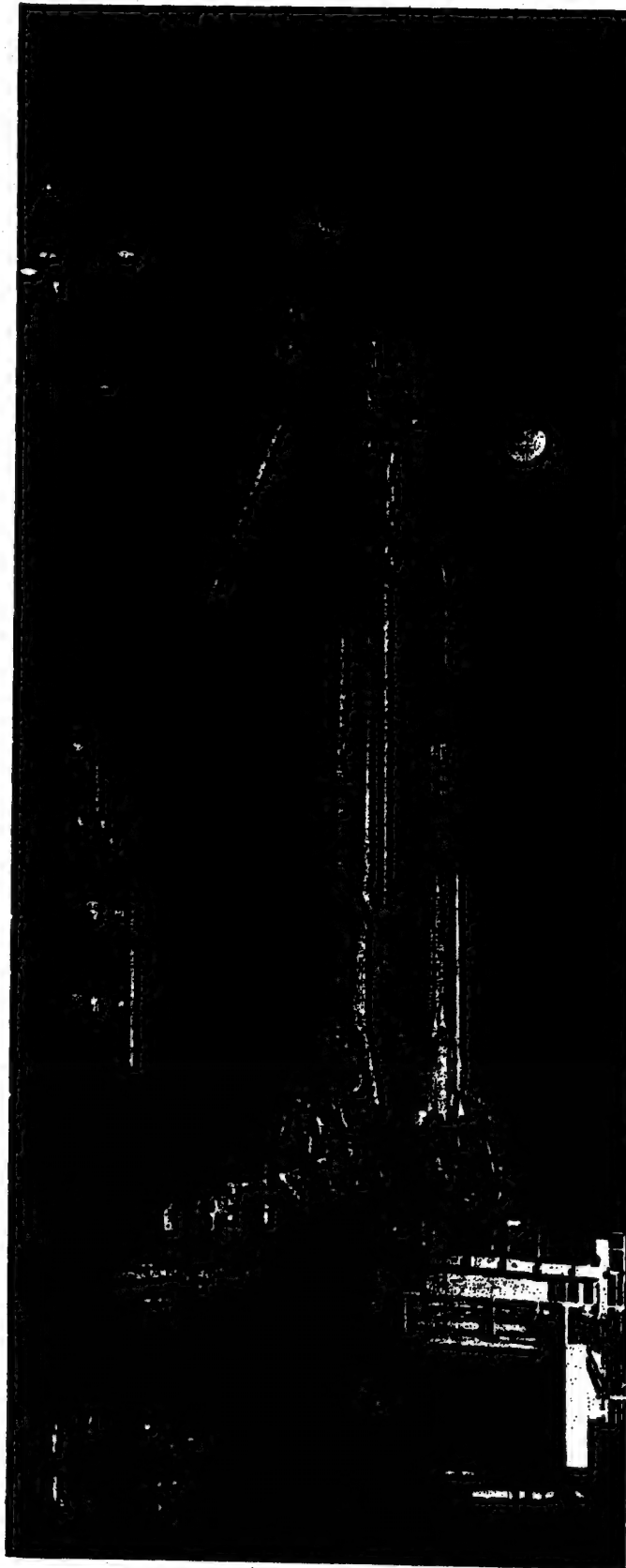
2. Demonstrate the compatibility of the ATLAS/AGENA Spacecraft configuration.

3. Demonstrate the capability of the Atlantic Missile Range and Deep Space Instrumentation Facility (DSIF) tracking, telemetry, and communications to provide the required data and control of the RANGER system during all phases of operation.

4. Demonstrate the ability of the launch control equipment, the AGE, and the launch procedures to launch the RANGER vehicle within severe time restrictions. (C)

● The RANGER 2 Spacecraft will contain eight scientific experiments designed to study the nature and activity of cosmic rays, magnetic fields, radiation, and dust particles in space. (U)

Figure 1. RANGER 2 VEHICLE (ATLAS 117D/AGENA 6002) on Atlantic Missile Range Stand 12. This flight, a lunar test mission, is scheduled for the period of 18 through 26 November.



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A. THIRD STAGE—X-248 (Allegany Ballistic Lab.)

Thrust at altitude	3150 pounds
Specific impulse (vac)	250 seconds
Total impulse	116,400 lbs/sec
Burning Time	37.5 seconds
Propellant	Solid

B. SECOND STAGE—AJ10-42 (Aerojet-General)

Thrust at altitude	7700 pounds
Specific impulse (vac)	271 seconds
Total impulse (min)	870,000 lbs/sec
Burning time	115 seconds
Propellant	Liquid

C. FIRST STAGE—THOR IRBM

Thrust (s. l.)	151,500 pounds
Specific impulse (s. l.)	248 seconds
Specific impulse (vac)	287 seconds
Burning time	158 seconds
Propellant	Liquid

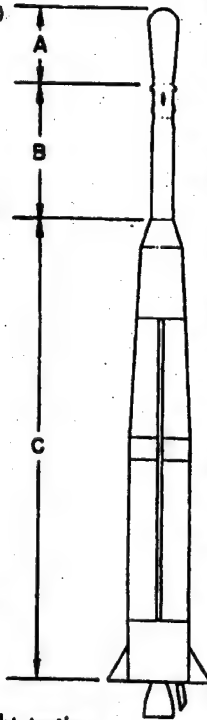


Figure 1. TRANSIT IA three stage flight vehicle.

The TRANSIT Program consists of the flight testing of seven vehicles to place 200-450-pound satellite payloads into circular orbits of 400 to 600 nautical miles. The program is designed to provide extremely accurate, world-wide, all-weather navigational information for use by aircraft, surface and subsurface vessels, particularly in relation to POLARIS missile firings. The ARPA Order for TRANSIT IA was initiated in September 1958 and amended in April 1959 to

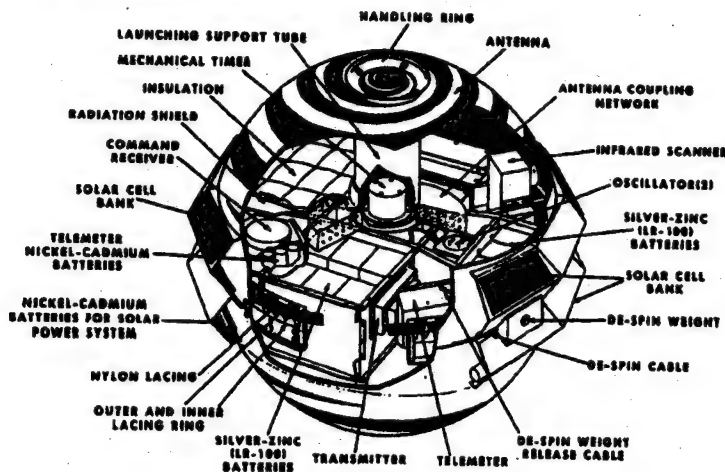
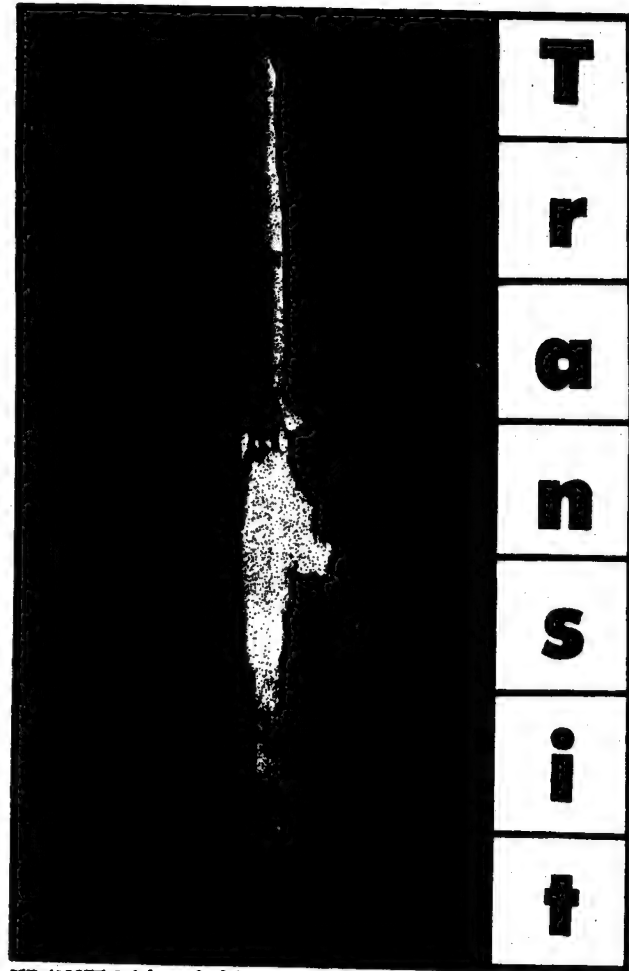


Figure 2. Cut-away drawing of TRANSIT IA payload (NAV 1).

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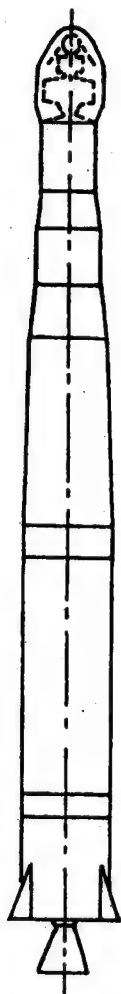


TRANSIT 3A launched from Atlantic Missile Range

add TRANSIT 1B, 2A and 2B flights. The TRANSIT 3A and 3B flights were initiated by a Navy, MIPR, dated 18 May 1960. Because of the successful TRANSIT 2A launch and excellent payload performance the Navy elected to Launch TRANSIT 3A rather than 2B. TRANSIT 2B was scheduled to carry the same type payload as was carried on the 2A flight. Subsequently, the Navy initiated requests for TRANSIT 4A, 4B, 5A and 5B. The TRANSIT 5A and 5B vehicles are scheduled to be used for other purposes.

The program was originally authorized by ARPA Order No. 97-60, which assigned AFBMD responsibility for providing the booster vehicles, integrating payloads to the vehicles, and flight operations from launch through attainment of orbit. The TRANSIT project was transferred to the Navy on 9 May 1960. The Navy has now assumed both the administrative and technical responsibility for the TRANSIT program. Payload tracking responsibility has been assigned to the USN Bureau of Weapons. Applied Physics Laboratory is the payload contractor.

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SECOND STAGE — ABLESTAR (AJ10-104)

Thrust (vacuum)	7900 pounds
Specific impulse (vacuum)	277 seconds
Burning time	296 seconds
Propellant	IRFNA UDMH

FIRST STAGE — THOR IRBM

Thrust (sea level)	152,000 pounds
Specific impulse (sea level)	247 seconds
Burning time	163 seconds
Propellant	Liquid Oxygen RP-1

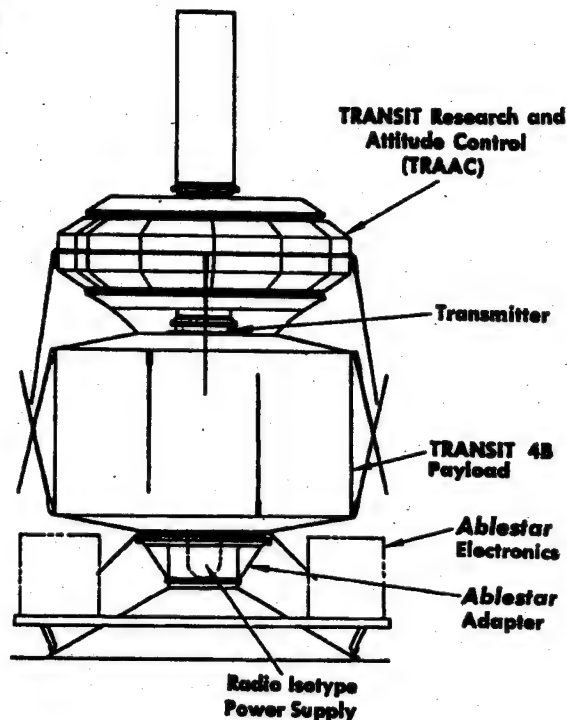


Figure 4. Payload arrangement for TRANSIT 4B flight.

Figure 3. Two stage vehicle used for TRANSIT 1B and subsequent flights.

Program Objectives

1. Provide accurate navigational reference information for POLARIS launches.
2. Precise determination of satellite position by measuring the doppler shift of satellite transmitted radio signals.
3. Investigate the refractive effect of the ionosphere on radio transmissions.

4. Acquire additional geodetic and geographical data by precision tracking of the orbiting satellite.

Flight Vehicles TRANSIT 1A was a three stage vehicle as shown in Figure 1. TRANSIT 1B and subsequent vehicles are two stage vehicles as shown in Figure 3.

Launch Plans All vehicles will be launched from Complex 17 at the Atlantic Missile Range. Launch azimuth will vary between 45.5° and 140° for each flight.

Payload Description

The TRANSIT 4B vehicle will carry a dual payload consisting of TRANSIT 4B and TRANSIT Research and Attitude Control (TRAAC). The programmed payload weight is 445 pounds, which breaks down as follows: TRANSIT 4B — 192 pounds, TRAAC — 238 pounds and Ablestar adapter — 15 pounds. The TRANSIT payload is the next step in the Navy program to develop an operational navigation system. The payload is a short cylinder with slightly convex ends. This payload will carry a Radio Isotope Power Supply as did TRANSIT 4A. This radioactive power supply provides electricity for several satellite systems. The TRAAC payload consists of an old-style TRANSIT instrument platform surrounded by a band of solar cells with a cylinder on the top. The slender cylinder contains a magnetometer and radio antennae. This payload, as its name implies, will carry specialized experiments investigating problems associated with advanced TRANSIT payloads. Both payloads are under the cognizance of Applied Physics Laboratory.

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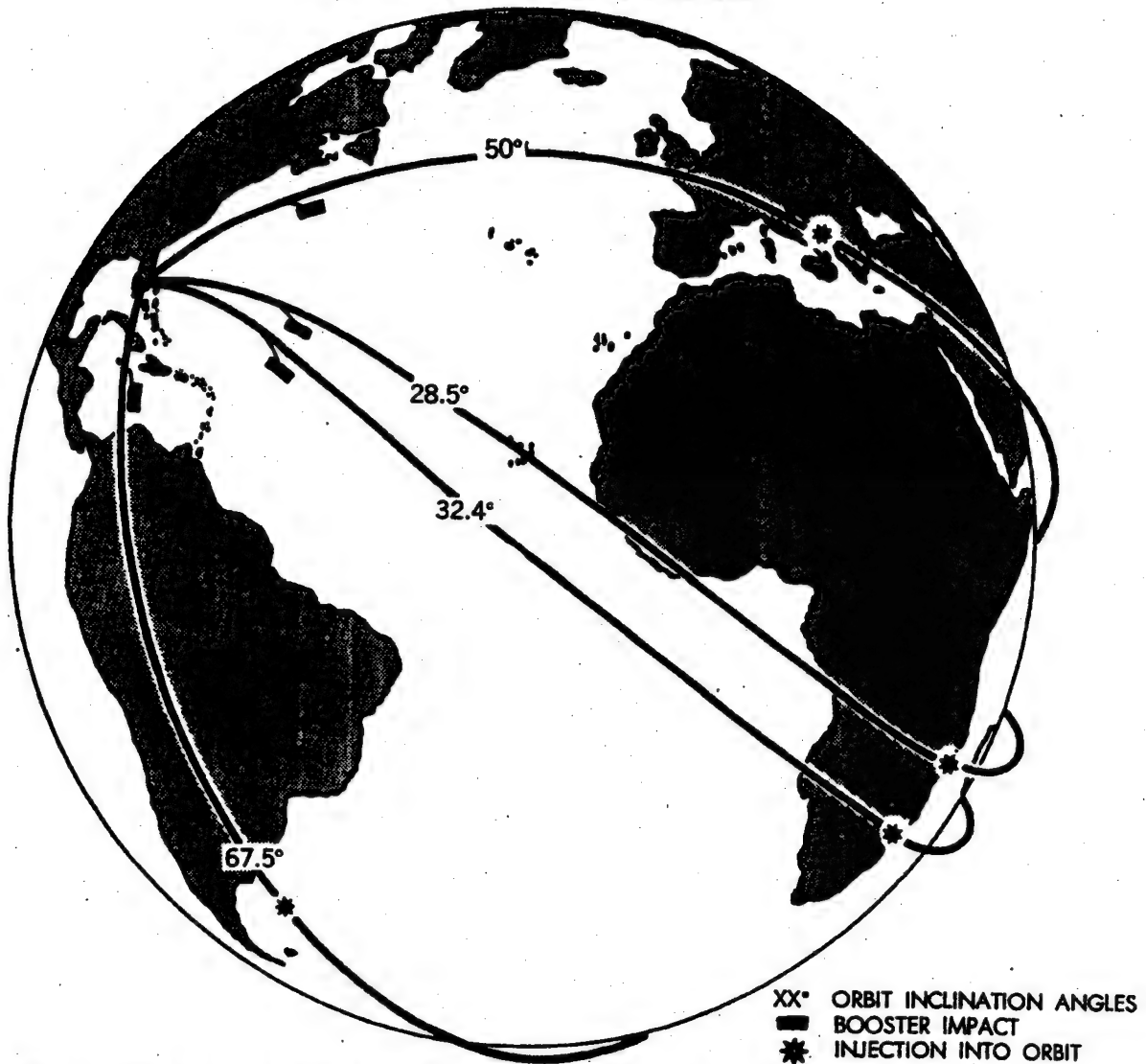


Figure 5. Typical TRANSIT launch trajectories showing flight path, booster impact areas, and orbital injection points.

Orbital Performance Achievement of program objectives is based primarily on measuring the doppler shift of satellite transmitted radio signals. During the first three months of flight, the four transmitters will be operated to obtain experimental confirmation of the theoretical mathematical relationship between the frequency and the refractive index of the ionosphere. Studies have shown that refraction effects on the doppler shift can be eliminated by using the simultaneous transmission from two or more frequencies from each satellite. After four months of tracking the satellite by measuring the doppler shift of the satellite radio signal, the exact position of the satellite at any point in the orbit should be known. Using known orbital positions, ships and aircraft can then use satellite signals to make analogous computations to establish accurate position.

Ground Support and Tracking Stations The Navy Bureau of Weapons payload contractor provides a system of payload tracking stations which obtain information for precise orbit determination. These stations are located in Maryland, Texas, New Mexico, Newfoundland and Brazil. First and second stage tracking and telemetry, and second stage guidance will be provided by the facilities of the Atlantic Missile Range. A mobile downrange tracking station at Punta Arenas, Chile, will receive telemetry data and tracking information during the last portion of the second stage Ablestar coast, re-ignition and second burn, payload spin-up and payload injection periods. This station was located in Erding, Germany, for the TRANSIT 1B flight, Punta Arenas, Chile, for the TRANSIT 2A and 3A and Pretoria, Union of South Africa for TRANSIT 3B.

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Launch Schedule

1959					1960										1961										1962												
J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J		
TRANSIT FLIGHT NUMBER																																					
1A					1B					2A					3A					3B					4A					4B C1							
	0										★		★					0					★														
A					A					B					B					C					B					D B							
ORBIT INCLINATION ANGLES A. 50° B. 67.5 C. 28.5. D.32.4°																																					

★ Attained orbit successfully

0 Failed to attain orbit

Flight History

TRANSIT No.	Launch Date	Thor No.	Ablestar No.	Remarks
1A	17 September	136	—	The three-stage vehicle was launched from Stand 17A at the Atlantic Missile Range. The payload was not injected into orbit, because the third stage motor failed to ignite.
1B	13 April	257	002	The Thor Ablestar boosted satellite was launched from Stand 17B at AMR. The satellite was placed into orbit. The Ablestar second stage (on its first flight test) fired, shut off, coasted, and then restarted in space.
2A	22 June	281	003	A dual payload, consisting of TRANSIT 2A plus GREB (which studied solar emissions), was placed in orbit by the Thor Ablestar vehicle. A propellant slosh problem, discovered in the second stage, has been corrected.
3A	30 November	283	006	TRANSIT 3A failed to achieve orbit when the first stage Thor shut down prematurely, after a failure in the main engine cutoff circuitry. Staging occurred and the second stage performed nominally until it was cut off and destroyed by Range Safety.
3B	21 February	313	007	TRANSIT 3B was launched with only partial success. The Ablestar stage failed to restart in space and the payloads did not separate. Although no definite cause has yet been determined, the counting device in the Ablestar programmer is considered the most probable cause of malfunction.
4A	28 June	315	008	TRANSIT 4A was launched, with great success, into an orbit with a perigee of approximately 460 n.m. and an apogee of approximately 540 n.m. The payload consists of three separate satellites: the TRANSIT 4A, containing the first radioactive power supply to be used in space; INJUN, which studies radiation in the lower Van Allen and auroral zones; and GREB, which studies solar X-Ray emissions.

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MONTHLY PROGRESS—TRANSIT

Flight Test Progress

● At the request of the Navy, the orbital inclination angle for TRANSIT 4B was changed from 28.5° to 32.4°. The resulting new launch azimuth of approximately 107° shortens the time required for the second stage to cross Africa which results in a lower total probability of land impact. (C)

● Because of the increased payload weight and the requirements for the 32.4° orbit inclination, the Space Systems Division determined that it was not possible to meet the Navy's request to place the payload into a 600 nautical mile nearly circular orbit. When so informed, the Navy modified its requirements for orbit altitude to 550 nautical miles circular. Space Systems Division has determined that this requirement can be met within the desired three sigma probability limits. (U)

● The launch date for TRANSIT 4B has been slipped one day, to 15 November, by the Atlantic Missile Range to correct minor range scheduling problems. An extremely tight launch schedule still exists at the Atlantic Missile Range during November and

December. Any additional slippage could adversely affect other NASA and Space Systems Division THOR launches. (C)

Technical Progress

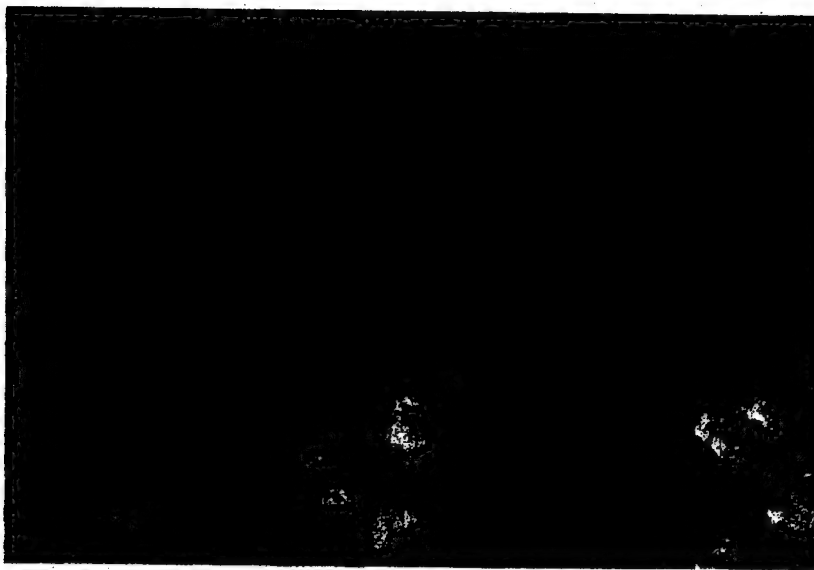
● The DM-21A/Ablestar launch vehicle for TRANSIT 4B (DM-21A No. 305/Ablestar No. 009) has been placed on stand and mated. The payload will be placed on the Ablestar on 10 November 1961. All booster systems are on schedule for this launch. (C)

● Because of the inability of the Satellite Test Center at Sunnyvale to accomplish the orbit determination task for TRANSIT 4B and COMPOSITE I as presently scheduled, this effort has been transferred to the Aerospace Corporation who in turn have sub-contracted it to Space Technology Laboratories, Incorporated. STL will reactivate the SpaN Center to accomplish this task. (U)

● Ablestar 010, which will be the second stage booster for the COMPOSITE I mission, has been accepted and airlifted to the Atlantic Missile Range. Both it and the DM-21A booster 311 are undergoing final assembly and checkout at the Atlantic Missile Range. (U)

SPACE

BOOSTERS



**EXISTING OR PROGRAMMED
STAGES**

SPACE BOOSTERS

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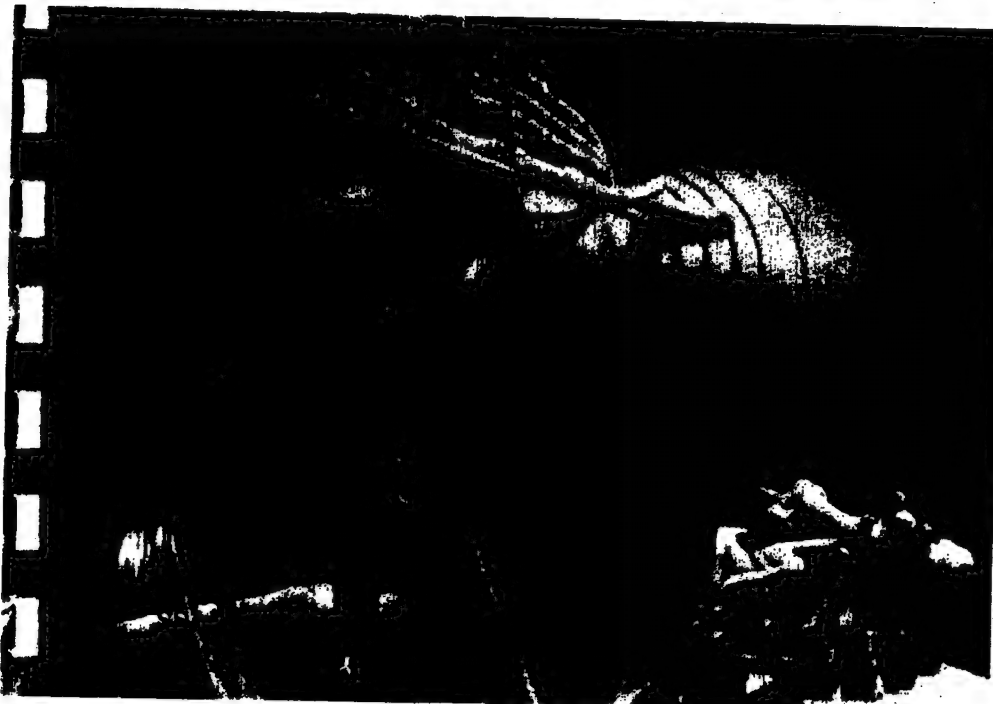
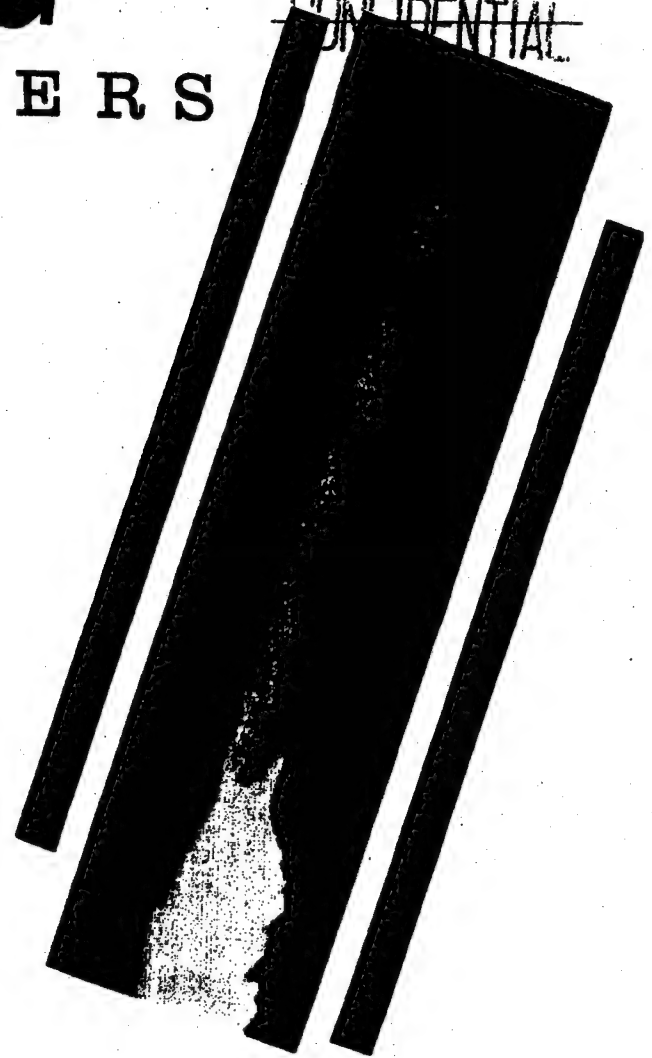
Space Program

BOOSTERS

● The primary pacing factor in the accomplishment of space missions has been, and for some time will continue to be, the availability of Air Force ballistic missiles and upper stages to boost the payload vehicle. Space flight planning requires close examination of all technological areas wherein advances provide increases in booster and mission capability. This, in turn, has required that space schedules be sufficiently flexible to incorporate rapidly those advances in the state-of-the-art which increase the potential for reliable and predictable space research.

● Because of the wide range of its activities, The Air Force Space Systems Division has accumulated a broad base of experience in booster selection for space missions. Experience in ballistic missile R&D programs and in development of upper stage vehicles have provided much information. Research programs in the propellant and materials areas also are providing new capability for space research. The number and variety of boosters available permit the selection of a combination of stages tailored to provide specific capabilities for specific missions.

● The following pages describe briefly the booster vehicles currently being used by The Air Force Space Systems Division to support military and civilian space programs. Nominal performance data is given to permit nominal comparisons of vehicle capabilities. Specific qualifications are made where necessary for clarity.



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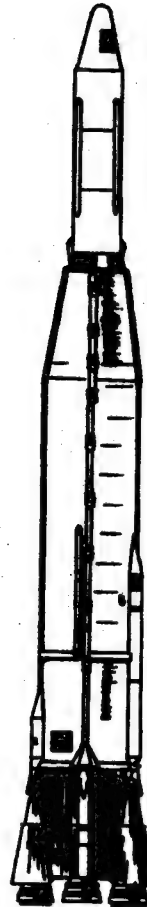
DM-19/AJ10-118/
ABL X248-A5



DM-21/Abilestar



DM-21/AGENA B



ATLAS D/AGENA B



ATLAS D/CENTAUR

Program Vehicle Combinations

ABLE - 1, - 3 and - 4..
ABLE - 4 and - 5.....
ADVENT (Phase One) ..
ADVENT (Phase Two) ..
ADVENT (Phase Three) ..
ANNA

A	M	R
E	M	R
	E	K
	E	P
	E	O
	D	N
	D	N
	A	H

DISCOVERER (16 thru 19)
DISCOVERER (20 and subs)
DYNA SOAR

C	I
C	K
E	H
E	K
E	K
C	K

NASA Delta

B	L	D
	F	H
	E	L
	E	L
	A	D
		N
	E	

SAINT

SNAPSHOT

TIROS

TRANSIT 1A

TRANSIT 1B thru 5B ..

VELA HOTEL.....

NOTE: Light type indicates completed programs

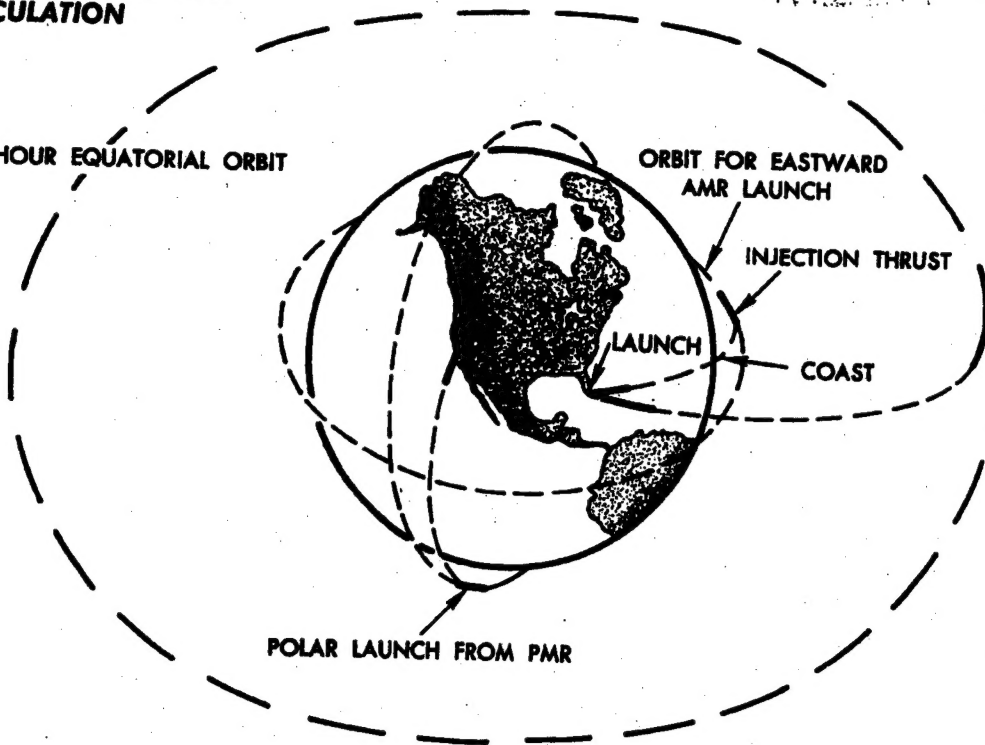
Bold type indicates active programs

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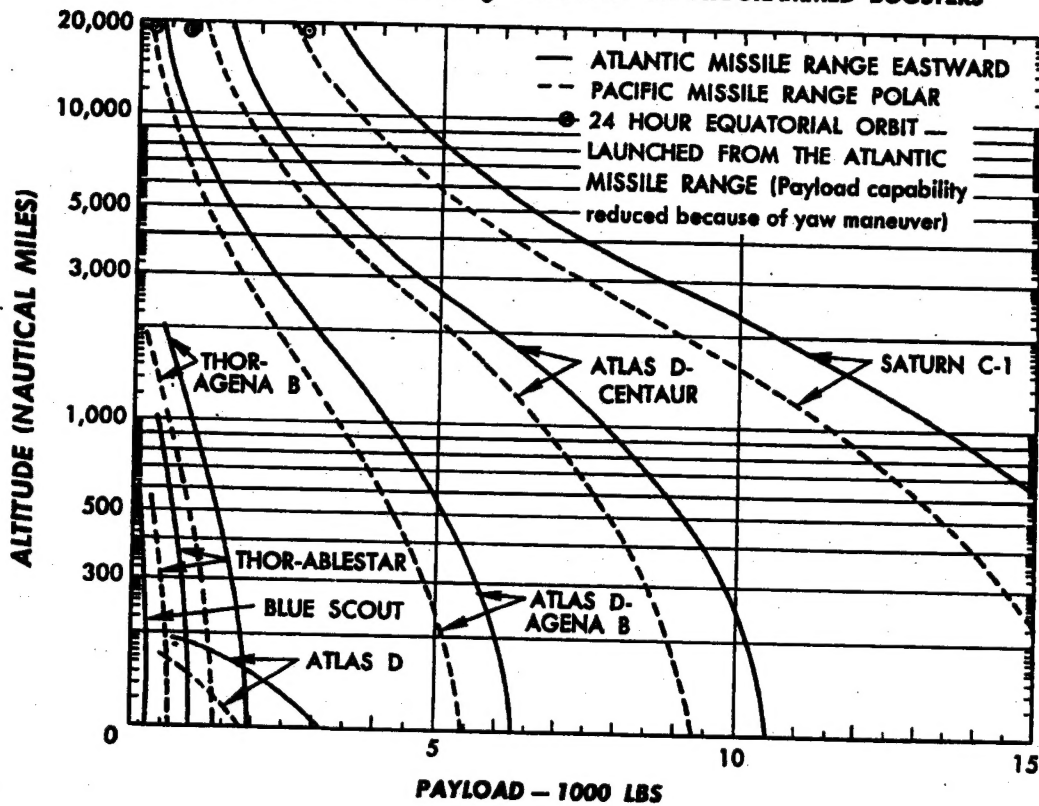
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LAUNCH CAPABILITIES CALCULATION

24 HOUR EQUATORIAL ORBIT



Performance Summary — EXISTING OR PROGRAMMED BOOSTERS



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SECRET Specifications

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BOOSTERS

THOR — Douglas Aircraft Company

	A	DM-18	B	DM-19	C	DM-21	D	DM-21A
Weight — dry		7,846		7,204		6,590		6,870
Fuel — RP-1/RJ-1*		31,500		31,500		33,500*		31,500
Oxidizer — Liquid Oxygen		68,000		68,000		68,000		68,000
Total		107,346		106,704		108,090		106,370
Height — feet		61.3		65.1		55.9		60.4
Engine — Rocketdyne Division of North American Aviation		MB-3 Block I		MB-3 Block I		MB-3 Block II		MB-3 Block I
Thrust — lbs. (sea level)		152,000		152,000		169,000		152,000
Spec. Impulse — lb.-sec/lb. (sea level)		247.0		247		250		247
Burn Time — seconds		160		160		149		160
Guidance — Bell Telephone Laboratories series 400 or autopilot only.								

ATLAS — General Dynamics-Astronautics

	E	Series D
Weight — dry		15,100
Fuel — RP-1		74,900
Oxidizer — Liquid Oxygen		172,300
Total		262,300
Height — feet		69
Engine — Rocketdyne Division of North American Aviation		MA-3
Thrust — lbs. (sea level)		309,000
Booster		57,000
Sustainer		2,000
Vernier		
Specific Impulse — lb.-sec/lb. (sea level)		
Booster		251
Sustainer		214.7
Guidance — Radio Mod II/III — General Electric (radar), Burroughs (computer)		

UPPER STAGES

R ABL X248-9 Allegany Ballistics Laboratory

Weight — wet	60
Propellant — Solid	459
Total	519
Height — feet	
Engine	
Thrust — lbs. (vacuum)	2,750
Specific Impulse — lb.-sec/lb. (vacuum)	254
Burn Time — seconds	42.1

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ENTIA Existing or Programmed Stages

SATELLITE VEHICLES

AGENA — Lockheed Missiles and Space Company

ENGINE MODEL — Bell Aerospace Systems	H YLR-81 Ba-5	J YLR-81 Ba-7	K YLR-81 Ba-9 ^③
① Weight — inert	1,262	1,328	1,346
Fuel — UDMH			
Oxidizer — IRFNA			
② Total	8,165	14,789	14,807
Height — feet	14	19.5	21
Engine			
Thrust — lbs. (vacuum)	15,600	15,600	16,000
Specific Impulse — lb.-sec/lb. (vacuum)	277	277	290
Burn Time — seconds	120	240 ^④	240 ^④

ABLE Series — Aerojet-General Spacecraft Division

	L AJ10-42 (and -118)	M AJ10-101 (and -101A)	N AJ10-104 (Ablestar)
Weight — wet	1,247	848	1,297
Fuel — UDMH	875	869	2,247
Oxidizer — IRFNA	2,500	2,461	6,227
Total	4,622	4,178	9,771
Height — feet	18	16	15
Engine			
Thrust — lbs. (vacuum)	7,670	7,720	7,900
Specific Impulse — lb.-sec/lb. (vacuum)	267	268	277
Burn Time — seconds		113	296

CENTAUR — General Dynamics-Astronautics

	P	Q
Weight — dry	2,891 ^⑤	
Fuel — Hydrogen	—	
Oxidizer — Liquid Oxygen	—	
Total	32,000	
Height — feet	45.5	
Engines (Two) — Pratt & Whitney	RL10A-3	
Thrust — lbs. (vacuum) (15,000 each)	30,000	
Minimum Specific Impulse — lb.-sec/lb. (vacuum)	420	
Burn Time — seconds	370	

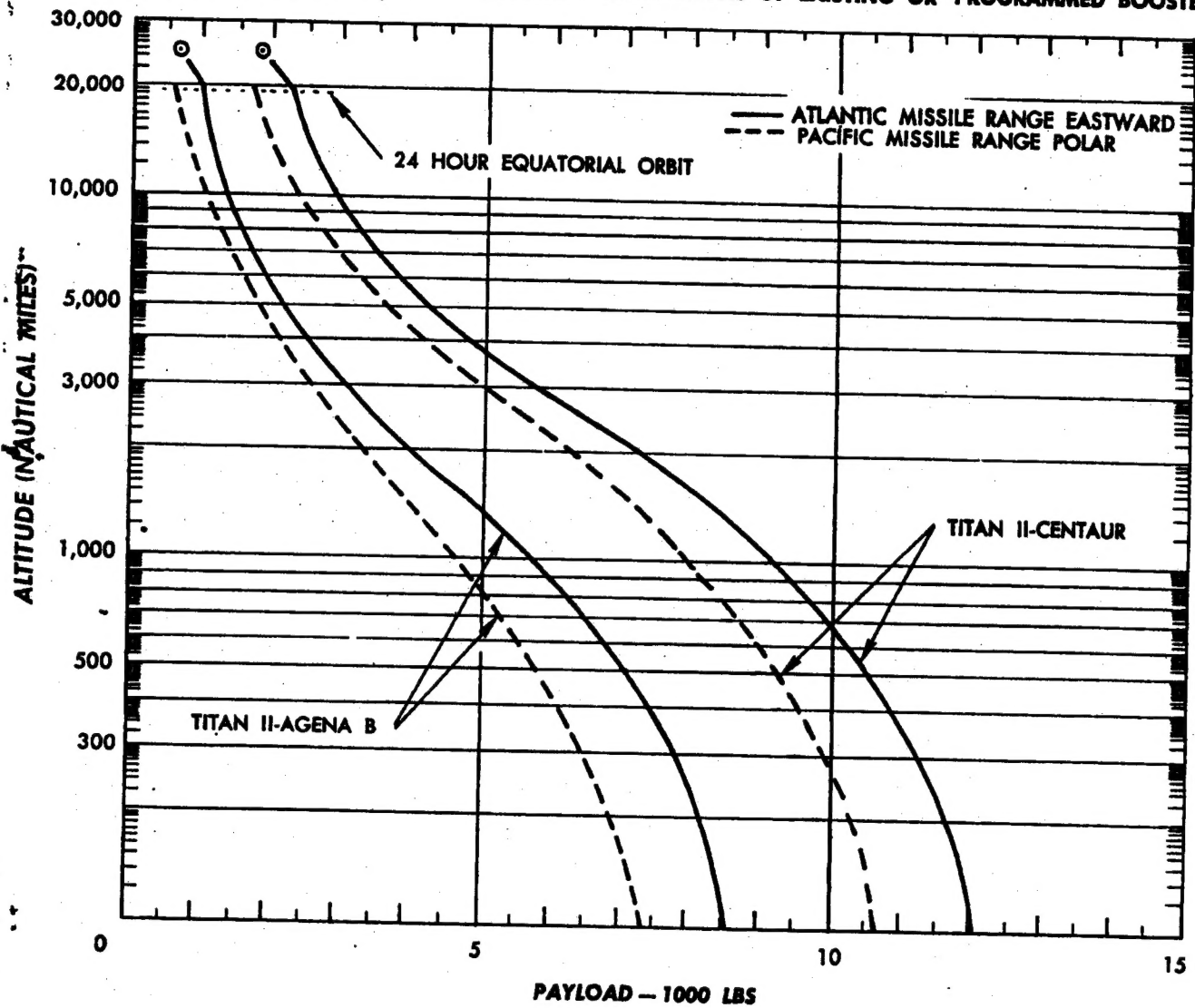
CENTAUR modifications necessary to meet ADVENT mission are being determined

NOTES:

- ① Payload weight not included. Does include controls, guidance, APU and residual propellants.
- ② Does not include THOR adapter (225 lbs.) or ATLAS adapter (315 lbs.)
- ③ Single restart capability
- ④ Dual burn capability
- ⑤ Changes in payload weight affect fuel and oxidizer weights, but not total weight.

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Performance Summary — POSSIBLE COMBINATIONS OF EXISTING OR PROGRAMMED BOOSTERS



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